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The Impact of Technical Innovation on Voter Registration and Turnout

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THE IMPACT OF TECHNICAL INNOVATION ON VOTER REGISTRATION AND TURNOUT:

Evaluating Online Voter Registration, Online Balloting Services,
and Paperless "Motor Voter" in Maryland's 2012 Presidential General Election

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ABSTRACT

Research on provisional ballots is nearly nonexistent and research on military and overseas civilian absentee ballots is limited. While the percentages of those voters are small, they are still substantial enough to swing close elections, so ensuring that every eligible voter has his or her vote counted is essential and research is needed in order to identify ways to improve processes for these voters.

By the 2012 Presidential General election, the Maryland State Board of Elections (SBE) had implemented Online Voter Registration (OLVR), Electronic (or paperless) Motor Voter (EMV), and Online Absentee Request (OAR). Maryland also did a redesign of the Online Ballot Delivery system for UOCAVA voters (OBD), including a ballot marking wizard as an option. These systems were implemented with the intention of reducing provisional ballots and reducing the late ballots for UOCAVA voters. Because these types of systems are so new to the U.S. election administrations, no research on their effectiveness has yet been published.

This research project briefly describes each of the new technologies and analyzes registration and turnout statistics in order to determine if the new systems achieved the Maryland SBE's goals. The results show that the voter registration systems effectively reach all demographics, although unaffiliated voters show a greater likelihood of using OLVR. While provisional turnout was not reduced, voters who made use of the new registration systems were less likely to vote provisionally. The results also show that OBD reduces ballot transit time and allows ballots sent later than by mail to still be returned on time.

More research is needed to fully evaluate the effectiveness of the new systems because Maryland did not have a large enough population of UOCAVA voters for a strong analysis and because discrepancies in the ways other states reported UOCAVA data on the Election Assistance Commission (EAC) statistical report prevent a solid cross-state analysis. Also, more research on provisional voting is needed to determine the full impact of the new registration methods. However, initially the systems appeared to achieve their stated goals by

improving the likelihood that provisional ballots and UOCAVA absentee ballots would be accepted.

DECLARATION

I hereby certify that this project constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions or writings of another.

I declare that the project describes original work that has not previously been presented for the award of any other degree of any institution.

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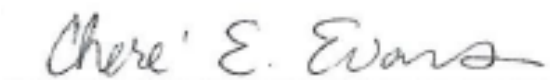

Chere’ Evans

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Background of the Problem

Elections in the United States can be said to have one primary goal from which all administrative functions extend: successfully determining the will of the eligible voting population. While the administrative tasks associated with elections are many and varied, this goal can only be met when voter turnout is maximized and the votes cast are accurately recorded; thus all major activity revolves around improving overall turnout and perfecting vote canvassing. However, prior to turning out to vote, in nearly all U.S. states a voter must first be registered to vote. This report focuses on how technology may be useful for improving the registration process, thus increasing the pool of voters who are eligible to turn out to vote.

Turnout Importance. Turnout level is important to the effective representation of citizens because one cannot assume that the variations of political and social views are represented equally in voters and nonvoters (Hansford & Gomez, 2010, p2). In fact, while studies disagree as to the exact effect greater turnout would have, the literature generally agrees that nonvoters have different political opinions and, were they to actually vote, election outcomes would be noticeably different (Hansford & Gomez, 2010, p2). Therefore, any innovation that significantly improves turnout among infrequent or nonvoters could effectively create a government with a better representation of all citizens.

Turnout Types. In the context of this study, voter turnout not only refers to the number of persons who cast an accepted ballot but also to the method by which they voted. Improvement of voter turnout means both increasing the number of people who cast a ballot and also increasing the number of accepted (and thus counted) ballots. Below is a brief description of the primary methods of voting in the United States:

Polling Place. A polling place ballot is cast in an official polling location on standard ballot[1]. These ballots are automatically accepted because voter eligibility has been confirmed in advance. For purposes of this report, polling place ballots include both those cast at the official polling places on election day and those cast at official vote centers during an assigned time of early voting, and thus the majority of turnout is represented in this category. Part of the goal of improved turnout in most states is to increase the number of polling place voters. The exceptions are those places which have mail-only elections, such as Oregon and most counties in Washington.

Provisional. Provisional ballots are cast by voters who come to the polling place on Election Day or during an early voting period but are unable, for a variety of reasons, to vote on a regular ballot. These voters are provided provisional ballots[2], along with some type of voter registration application. They then manually complete the ballot and during canvass[3] the election officials evaluate the eligibility of the vote, either accepting and counting the ballot or rejecting it. HAVA requires that a voter whose name is not on the list of polling place eligible voters has the right to vote provisionally. It further states that the state or local election officials have to count that ballot for any voter who was eligible to vote according to state law (HAVA section 502a). This provides a baseline requirement, but due to differences in state law provisionally balloting is administered differently in each state. For example, Maryland law then permits a provisional ballot to be accepted in full if it was voted on the right ballot style, whether it was voted in the correct polling place or not. Maryland law also counts ballots cast on the wrong ballot style and just counts only those contests which were on

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[1] Several different polling place vote methods have been in use over the past century: lever machines, punch cards, direct recording electronic machines, optical scanners, etc. Some jurisdictions still use paper ballots. Evaluation of or even differentiation between the various types of machines is outside the scope of this report. Because in Maryland a regular ballot during the 2012 General election was a voting machine ballot, throughout the remainder of this paper the terms "voting machine ballot", "polling place ballot", or "regular ballot" may all be used to indicate standard voting procedures, as differentiated from provisional ballots cast at the polling place.

[2] As with regular ballots, the actual method of casting a provisional ballot may vary from state to state. During the 2012 General election in Maryland, provisional ballots were cast on paper.

[3] Canvass is the standard election term used to indicate the process of accepting, rejecting, and counting ballots.

both the ballot style voted and the ballot style the voter should have used (accepted in part). Finally, Maryland also accepts in part any ballots cast out of county. In contrast, in Florida a provisional ballot only counts if voted at the correct polling place for the voter; no "Accepted in Part" concept is part of their provisional law. Therefore, comparison across states requires an awareness of the legal differences in those states.

Absentee. Absentee ballots are cast by voters who do not come to the polling place but instead receive a ballot remotely, either by mail, fax, email, or over the Internet. In some states, including Maryland, an absentee ballot may be received in person at the local election board as well. The voter then completes the ballot, usually by hand but occasionally using some type of ballot marking software, and returns it. How a ballot can be returned is based on state-specific rules; the various return methods include mail only, email, fax, or in rare cases, Internet. During canvass, the ballot is evaluated for acceptance or rejection, based on state-specific rules. Usually, the ballot voted is the official one provided by the local election official, but certain types of voters may vote a Federal Write-In Absentee Ballot (FWAB) instead, which is a paper form that allows overseas and military voters to cast a ballot for federal offices even if they have not yet received their regular absentee ballot[4]. Eligibility for absentee ballots is determined at the state level, with some states permitting "no-excuse" absentees and others requiring that the voter certify that he or she will be unable to participate on election day (EAC, 2005). The acceptable excuses vary per state; however, all states are federally required to provide absentee ballots to those covered by the Uniformed and Overseas Civilian Absentee Voting Act (UOCAVA) of 1986.

Voter Types. While elections would be simplified if all voters could vote the same way, the voting population is too varied for such a simplistic approach. Even the states of Oregon and Washington, where nearly all counties have all-mail elections, have allowed for exceptions to the normal approach in order to accommodate certain types of voters. Below is a brief description of the major categories of voters.

Domestic. These nonmilitary voters live in their state of residency and are the most likely to be able to vote in the polling place. Most voters fall into this category.

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[4] Federal law requires that states permit use of the FWAB for voting for federal offices. Some states, including Maryland, also permit the FWAB to be used to vote for state and local offices.

Military. Voters who are active in the military are the most mobile population and they are frequently overseas. Some may be in isolated regions that do not receive regular postal service. While they are able to vote in the polling place if they are stationed in their home state, many of them are forced to vote absentee because of their stations.

Overseas Civilian. These voters are temporarily or permanently overseas and thus must vote via absentee ballot.

Disabled. These are voters who may need accommodations to cast their ballot. They may be blind or have a visual impairment, physically disability, or or may not be able to leave their home to vote, etc. They could be domestic, military, or overseas civilians, and so could vote by any of the potential voting methods.

Legislation. In recent years the federal government has has passed a series of laws that directly impact election administration. A basic knowledge of these laws is important in order to understand the reasons behind the current technical innovations in elections.

UOCAVA.

The Uniformed and Overseas Citizens Absentee Voting Act (UOCAVA) of 1986 is a federal law which made important legal provisions for military and overseas voters, specifically extending the right to those voters to cast an absentee ballot in federal elections (U.S. Justice Department, n.d.a). UOCAVA voters may be military personnel, family members of military personnel, or citizen living permanently or temporarily overseas (U.S. Justice Department, n.d.b). UOCAVA mandates that states provide these citizens with the opportunity to register to vote[5] and request a ballot by mail and that states send out ballots with ample time for return. Further, the UOCAVA law allows for the Federal Write In Absentee Ballot (FWAB), which any UOCAVA voter can complete and mail in should the voter be concerned that the state absentee ballot will not be returned in a timely fashion. States must count any votes for federal office represented on a FWAB, as long as the voter has a valid, absentee request on file, assuming the state ballot is not returned in time for the election (U.S. Justice Department, n.d.b). Finally, UOCAVA required that any absentee ballot request by a covered voter be valid for two federal election cycles although the MOVE act later repealed this provision (Federal Voting Assistance Program, 2012).

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[5] Prior to UOCAVA, some jurisdictions required voter registration to be done in person.

NVRA.

Prior to The National Voter Registration Act of 1993 (NVRA), sometimes called the "Motor Voter Act", people who wanted to register to vote had to seek out the elections offices in order to register. NVRA mandated that certain service-oriented state agencies, particularly the Department of Motor Vehicles but also any other public assistance agency, provide voter registration forms to customers along with assistance in completing and returning the forms (EAC, 2005). NVRA authorized a national voter registration form that states must accept in addition to their own registration forms, dictated a voter registration deadline of no earlier than 30 days before a federal election, required strict voter registration roll maintenance, and disallowed removal of voters from the rolls after 90 days prior to an election (U.S. Justice Department, n.d.c). The expectation at the time was that this law would allow underrepresented economic classes more opportunities to register to vote and thus both improve overall turnout and ensure a more socio-economic equalized turnout, although the research generally does not demonstrate the achievement of that objective (Highton and Wolfinger, 1998).

HAVA.

Historically, all voter registration rolls were maintained at the local jurisdiction level, which meant either county or municipality. This made management of voter moves, name changes, deaths, or other changes difficult to manage, resulting in significant bloating of the rolls, which included deceased voters as well as those registered in other jurisdictions. It also resulted in otherwise eligible voters being turned away at the polling places due to problems with the registration records (EAC, 2005). The Help American Voter Act of 2002 (HAVA) attempted to resolve these issues by requiring state-level administration of the voter registration rolls and specifying certain pieces of information and identification voters must provide (Maryland State Board of Elections, n.d.a). HAVA also required that provisional ballots be made available during federal elections to voters who come to the polling place but would otherwise have been turned away. HAVA specifies that if the voter is determined to be otherwise eligible, provisional ballots must be counted if they are cast in the right jurisdiction. However, interpretation of the term "jurisdiction" varies from state to state, with some states accepting provisional ballots cast anywhere in the state, others accepting those cast in the right county, and some accepting those cast only in the right precinct (EAC, 2005).

MOVE. The Military and Overseas Voter Empowerment Act of 2009 (MOVE), an amendment to UOCAVA, is the most recent federal law designed to improve voter turnout in federal elections; specifically, it is intended to finish removing barriers to voting by military and overseas that the UOCAVA law had not fully addressed. MOVE required that absentee ballots be provided to UOCAVA voters at least 45 days prior to a federal election, so that fewer absentee ballots would be rejected as untimely. It also specified that voter registration application forms, absentee ballot request forms, and Federal Write-In Absentee ballot forms be made available online, although it is important to note that MOVE does not require electronic submission of those forms. It required that states provide a way of tracking the progress of the absentee ballot and that states accept ballots that are on nonstandard paper Finally, it also required that UOCAVA voters make a new absentee ballot request every election cycle (a change to the original UOCAVA law), so as to reduce the significant number of undeliverable UOCAVA absentee ballots (Whitmar, 2012).

Technology In Elections. The most common technical innovations in elections have historically been improvements to the ballot casting and tabulation process, specifically voting machines of various types. The voter registration and absentee voting processes are primarily paper-based; even though registration rolls are managed in modern database systems, the voters must complete paper forms with physical signatures in order to register to vote or complete ballots. However, in attempts to fulfill the aforementioned federal mandates, states have begun to implement several types of new technical innovations. For example, the states of Arizona, Delaware, and Maryland have implemented paperless, electronic "motor voter" registration (EMV). In order to better fulfill the MOVE act, several jurisdictions, such as Arizona, Kansas, Maryland, and Utah allow online submission of voter registration (OLVR), and Arizona, Washington, and Maryland are examples of states which provide online absentee requests for UOCAVA voters (OAR). Several states, including Arizona, Maryland, Kentucky and Rhode Island provide UOCAVA voters with an Online Absentee Ballot Delivery system (OBD. However, due to the newness of these technologies, little research has been done regarding their effectiveness in improving voter turnout and particularly not in the area of provisional balloting.

The 2011 Electronic Absentee System for Elections (EASE) grant by the Federal Voting Assistance Program (FVAP)[6] provided funds to multiple jurisdictions (county and statewide) which as of the writing of this report had either recently implemented or were still in the process of implementing innovative solutions for improving the voter experience while maintaining compliance with UOCAVA and the MOVE act, so the number of jurisdictions with these types of technical solutions grew significantly throughout 2012 and is expected to continue to grow during the 2014 and 2016 elections. Controversy still exists regarding how these technical solutions impact the security of the voter registration and absentee processes, but it is beyond the scope of this paper to evaluate those issues. In this study I examine the provisional balloting and UOCAVA absentee balloting and evaluate the effectiveness of the current technical solutions in solving those problems. I also review the demographics of those who make use of OLVR and EMV. FVAP is currently conducting a multi-year study of OLVR and OBD as they specifically pertain to absentees and UOCAVA voters, something the EAC also examines; however, I am more focused on the impact EMV and OLVR have on provisional turnout.

Statement of the problem

While North Dakota does not require voter registration in order to vote and some jurisdictions (such as Wisconsin) have Election Day Registration (EDR), "For most eligible citizens in the United States, the first step to participate in the electoral process is to register to vote" prior to Election Day (EAC, 2005). Then, if a voter changes his or her name or moves to a new residence, the voter must register to vote again in order to maintain voting eligibility (EAC, 2005).

Although HAVA and NVRA expanded the opportunities to register to vote and improved the administration of voter registration, and a variety of issues may still cause problems with a person's voter registration record. For example, a typo in an ID or name field can cause validation to fail; mistyping of a street address can cause residential address

[6] FVAP, a part of the federal Department of Defense, has been charged with promoting the voting experience for UOCAVA voters.

validation to fail; reliance upon paper-based systems can cause untimely or never-delivered voter registration applications, etc.

Provisional Turnout Issues. Provisional ballots are useful for solving the problem of voters whose registration applications were timely but who were either not included on the rolls or unfound due to poll worker error during the election. However, balloting problems occur when poll workers are unclear which ballot to provide to voters or which voters are eligible to receive provisional ballots (Alvarez & Hall, 2006, p497). Further, provisional balloting has exposed registration problems such as failed ID verification, never-registered voters, or voters with out-dated address information.

For example, Figure 1 Provisional Ballots Accepted and Rejected in Maryland displays the percentage of Provisional Ballots counted from 2006 through 2010 (Maryland State Board of Elections, 2006a, 2008a, 2008b, 2010a, 2010b). Because the overwhelming number of provisional ballots were accepted in full, it is clear that in Maryland provisional ballots have been effective in ensuring eligible voters are not mistakenly prevented from voting. Ballots that were accepted in part were cast by otherwise eligible voters who voted in the wrong polling place, sometimes because they moved to another location in their county, or starting in 2010 anywhere else in the state, but that information was not on the voter registration record. It is unknown how many of the Accepted in Part voters are convenience voters who intentionally vote out of county or precinct. For those who were not convenience voters, had the voters been properly registered at their appropriate addresses they would likely have been able to vote a regular ballot instead of a provisional one. This may also occur in polling locations which serve multiple precincts if the poll worker gives the voter the wrong ballot.

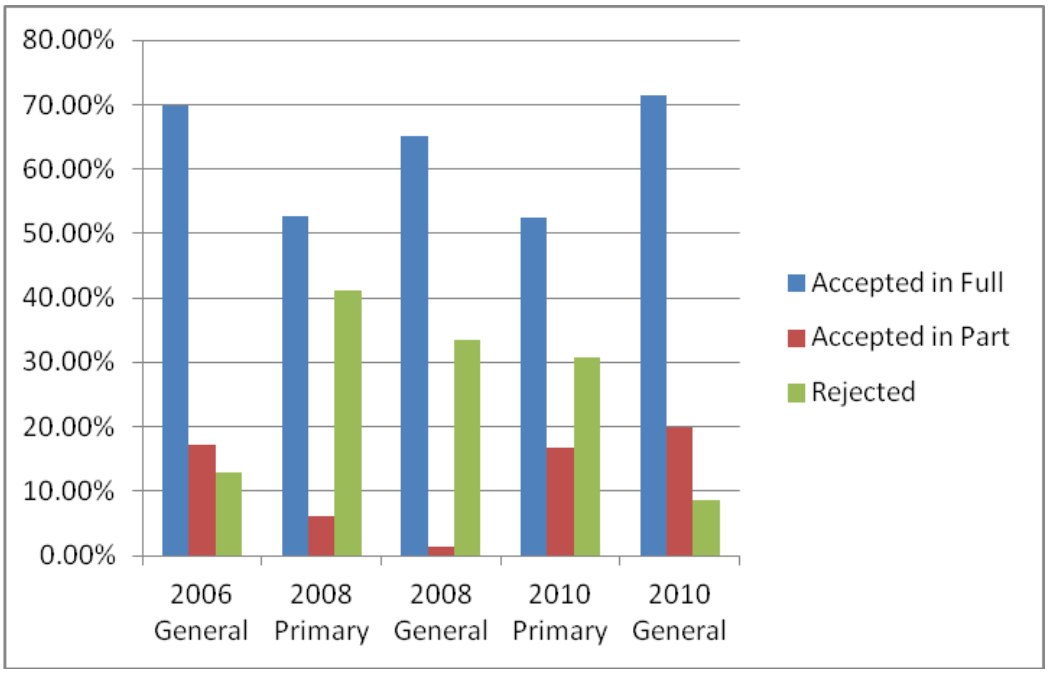

Figure 1 Provisional Ballots Accepted and Rejected in Maryland

The rejected ballots also demonstrate registration issues. Figure 2 Percent of Provisional Rejection Reasons in Maryland, (Maryland State Board of Elections, 2006a, 2008a, 2008b, 2010a, 2010b) shows that since November of 2006, more than half of the rejected provisional ballots in the state of Maryland were rejected for reasons relating to problems with the voter registration record: e.g, the voter was not registered at all, the voter had a problem with their ID or failed to provide ID in the first place, or the voter tried to vote in a primary for the wrong political party.[7] Other reasons for rejection usually relate to failure on the part of the voter to follow instructions regarding the provisional ballot and application: e.g., a lack of signature or extra markings on the ballot. Maryland Election Officials are also aware of voters who simply "wanted to vote for a candidate in the other county". While election administration improvements cannot prevent the voter from making a deliberate decision to vote in another county, election officials are continually searching for ways to prevent provisionals caused by administration related-issues.

[7] Maryland has closed primary elections, meaning that a voter may only vote in the primary of the political party for which he or she is registered. Provisional ballots rejected for the wrong party may be related either to the voter misremembering his or her party affiliation or to a registration error.

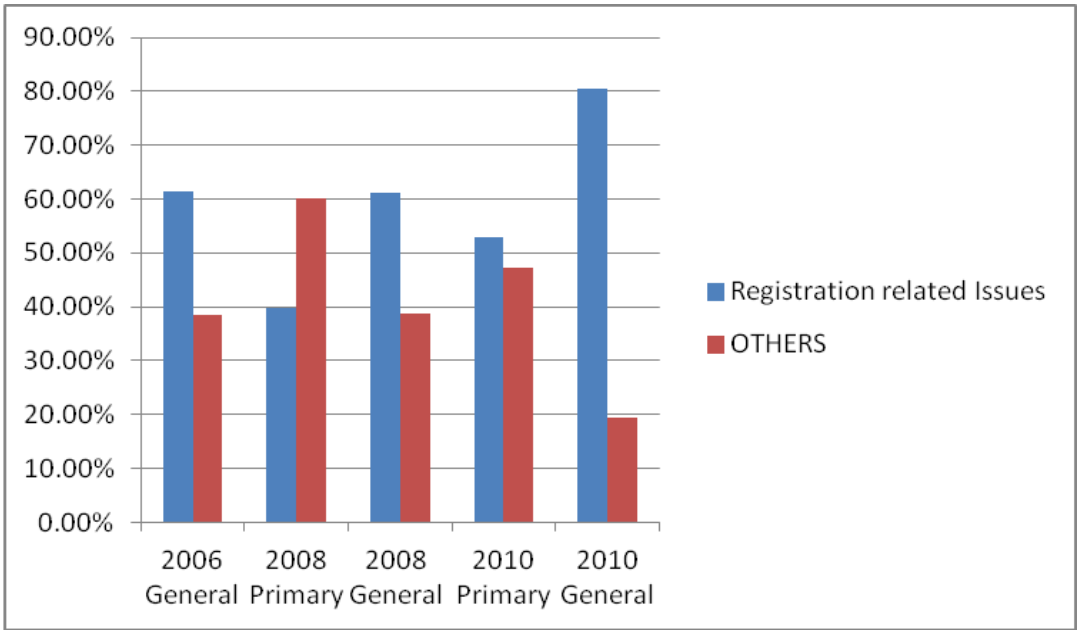

Figure 2 Percent of Provisional Rejection Reasons in Maryland

Figure 3, Overall Turnout in Maryland, shows the percentage of each type of turnout. While the provisional turnout makes up a very small percent of overall turnout in Maryland (between 1.5% and 2.5%), with between 10% and 30% of provisional ballots being rejected it is conceivable that close election results could be affected, especially in larger jurisdictions. Improvements to the overall elections process that decrease the total number of distributed provisional ballots and thereby reduce the actual number of rejected provisionals while increasing polling place turnout will contribute to the goal of more accurately capturing voter intent. It is important to note, however, that improvements to turnout that maximize the number of Polling Place voters while reducing the number of Provisional Voters may in fact cause the percentage of rejected provisionals to increase. This is because in the hypothetical case that 100% of eligible voters who arrive at the polling place successfully cast their ballots via the voting machines, the only provisional ballots cast would be by individuals who were not registered; therefore, their ballots correctly would be rejected.

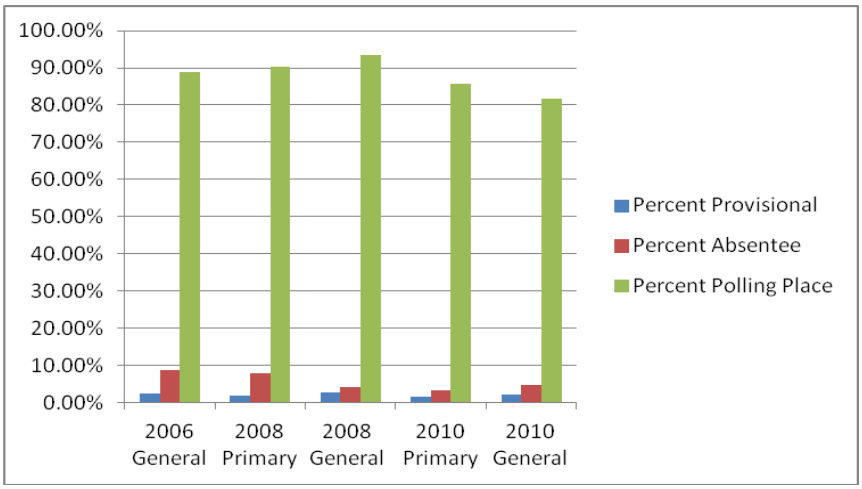

Figure 3 Overall Turnout Percents in Maryland

The provisional ballot trends across the United State are similar, although the number of ballots actually accepted varies widely by state. According to the EAC, in 2004 (prior to widespread HAVA compliance) provisional voting constituted approximately 2.56% of the overall turnout. According to the EAC reports of 2006,2008 and 2010, the provisional ballot rate has held steady since 2006 at about 1% (with a minor spike to 1.3% during the high profile 2008 presidential election). This implies that HAVA has been consistently effective in improving registration and ensuring eligible voters are able to vote as polling place voters. From this I also infer that continued improvements in voter registration may reduce the provisional rate even more, albeit slightly as the numbers are already low.

Rejection reasons by other states are also similar to the rejection reasons in Maryland. Consistent across all EAC surveys, the most common reasons for rejecting provisional ballots are due to registration issues of some kind, such as identification problems, wrong precinct, not registered , etc. As noted above, in the hypothetical, perfect election, 100% of the ballots would be rejected because the voter failed to register; so while this data exposes opportunity for improvements to the registration process, having high rates of rejection of voters who have failed to register cannot be assumed to be indicative of a problem unless that statistic is accompanied by other information such as unusually high provisional ballot rates.

Absentee Turnout Issues. In Maryland, absentee ballots are generally provided only for registered voters[8], so the rejection rate tends to be very low. More problematic is the number of ballots which are not returned by the end of canvass or which are never returned: anywhere between 10% and 35% of the ballots sent. Figure 4 displays the status of Absentee Ballots in Maryland as calculated on the Maryland State Board of Elections website, showing a less than 3% rejection rate, but a significantly high failure to return rate (2006)(2008a)(2008b)(2010a)(2010b). It is important to note that the original UOCAVA law required an absentee request to be valid for two federal election cycles. The MOVE act removed that requirement in 2010; however, Maryland still honored the requests through the d2010 elections. Maryland SBE believes the jump in the not returned ballots in 2010 is a result of those two-cycle absentee requests.

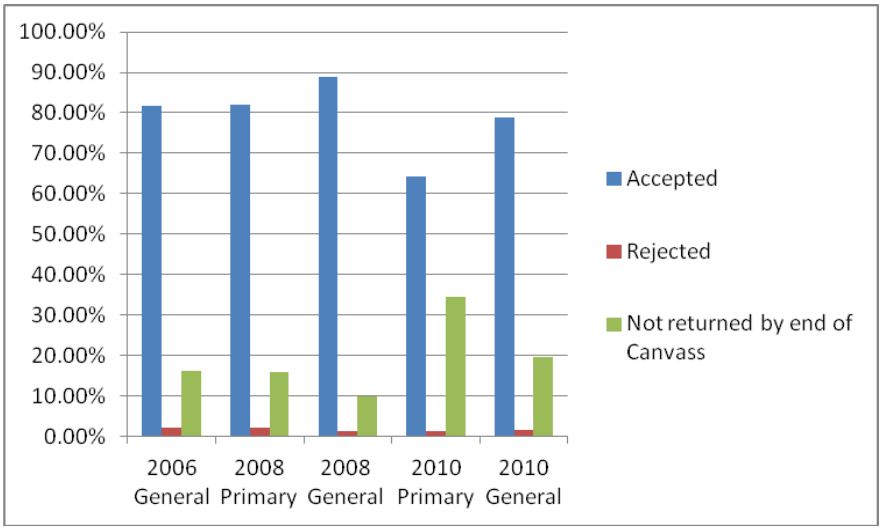

Figure 4 Absentee Ballot Status in Maryland

Despite the low rate of rejection, an examination of the absentee rejection reasons is still valuable. Figure 5 shows the reasons for absentee ballot rejection in Maryland, and the most striking statistic is that half or more of all rejected ballots were rejected for untimeliness, which, when combined with the number of absentee ballots never returned, indicates a potential area for improvement (Maryland State Board of Elections, 2006, 2008, 2010).

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[8] The exception is Federal Write In Ballots, which are Federally mandated blank ballots that a UOCAVA voter may complete and mail in. In Maryland, those ballots are not counted unless the voter is registered in Maryland and has already submitted an absentee ballot application. Rejected absentee ballots due to registration issues or lack of an absentee application are FWABs.

Further analysis shows that the majority of never returned and untimely ballots are for UOCAVA voters. Reducing the problems with timeliness is one of the goals Maryland had for Online Ballot Delivery when originally implemented in 2010 and when updated in 2012.

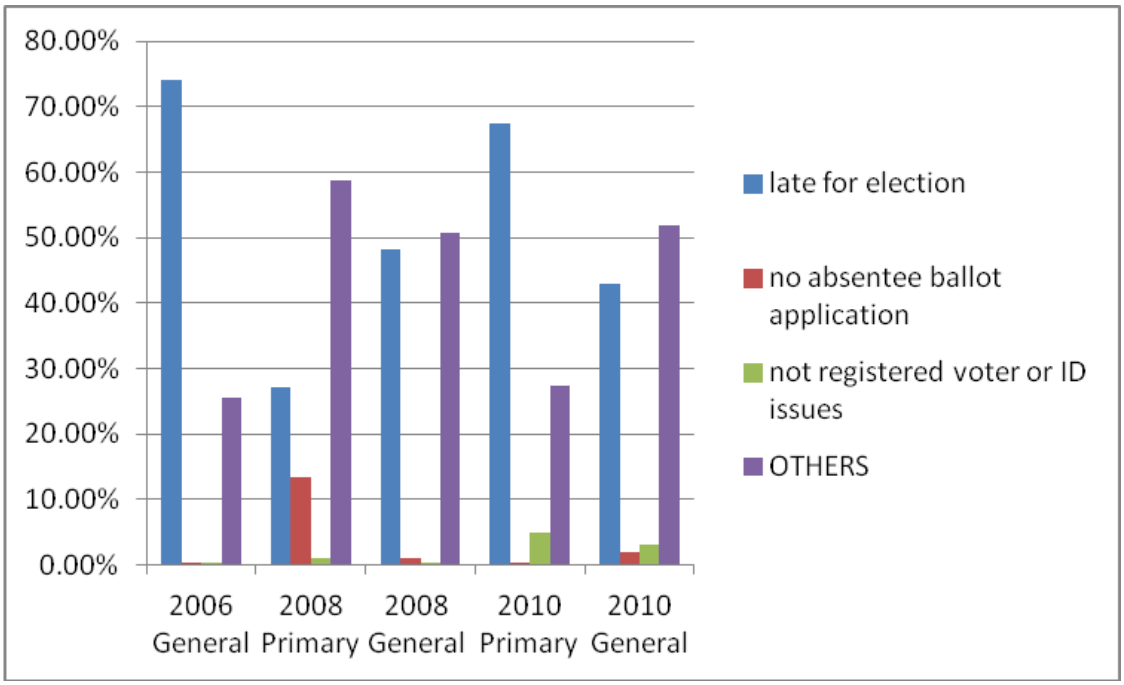

Figure 5 Absentee Ballot Rejection Reasons in Maryland

Just as with the provisional statistics, Maryland is not unique among the states. In fact, according to each EAC survey from 2004 through 2010, one of the most common reasons for rejecting an absentee ballot is that the ballot was not timely.

Another small percentage of ballots were rejected because the voter had a problem with their voter registration record or because no absentee ballot application was found on file. With between 3% and 8.5% of the votes cast being absentee (Figure 4), it is possible that close elections could have been swayed had some of those rejected absentees been accepted. Other reasons for rejection are typically related to failure on the part of the voter to follow instructions properly.

Problem Summary. The provisional ballot and absentee ballot rejection numbers clearly suggest that not all individuals interested in the election process are registered to vote or have updated their registration upon moving or changing names. It is understood that not all individuals who attempt to vote are actually members of the eligible voting age population

(e.g., noncitizens or felons), and it is not possible to gather the needed details for a factual breakdown, but I theorize that most of those individuals are in fact of the eligible voting age population and have either failed to follow local registration rules in a timely fashion or a technical problem prevent the voter record from being located at the polls on election day. This theory is justified in part by the fact that the high-interest 2008 General Election, an election which elicited many first-time voters, had the highest number of provisional ballots cast out of all Maryland Statewide elections and most of those were accepted.

Failure to register to vote and subsequent provisional ballot casting can be explained in large part due to the fact that the United States population is quite mobile: "Yearly current population reports from the Census Bureau have constantly shown that about 17 percent of this nation's population moves every year" (EAC, 2005). According to the most recent Census, over 20% of people over 5 moved within county in 2010, 6.7% of people moved out of county, 5.6% moved to a new state, and 1.5% of the population moved in from overseas (Ihrke and Faber, 2012). These individuals may move too late to register in their new state or they may not know where and how to register. While NVRA did address much of the mobility problem (in fact, according to the EAC, after NVRA voter registration as a percentage of voting age population increased by 7% (2005), it still does not address the problems for voters who are away from their home states or who are homebound and it does not address those who move after the voter registration deadlines.

Difficulty of Studying Elections

Wide Variety of Variables. Evaluating the efficacy of any of the election administration solution is challenging, in particular because political and social context vary greatly across jurisdictions. In order to obtain a valid evaluation of technology implementations, researchers must examine multiple elections across a large number of jurisdictions so as to obtain a significant sample size and to account for the large number of variables (Alvarez, Ansolabehere, & Stewart, 2005, p15-16). Research is further hampered by the fact that not all states report all the data needed for proper analysis and not all states truly report the data they claim to report (Alvarez, Ansolabehere, & Stewart, 2005, p15). As an example of how a state may report different information than what a researcher is requesting, the Maryland monthly statistical report provides counts of name, address and party changes

by source of registration. However, the address changes only refer to out-of-county moves and if a person changes name, address, and party all at once, that application is counted once in each category. While Maryland is reporting exactly what it intends to report, a researcher who wants to count only total applications would not be able to use that report.

Alvarez, Ansolabehere, & Stewart also explain that, in elections particularly, while 1% may not be significant in a single county, nationwide 1% is over one million voters, which could significantly impact an election. Therefore, analysis of any election related solution should cover a very large sample. They explain that a study of a single county or even a single state, while informative and interesting, will not have a large enough data set for applicability nationwide. They also recommend including demographic and political information to control for unnoticed variables. However, this data is often difficult to get at the precinct level, further complicating analysis (2005, p16). Further, collection of that data is challenging; state election officials are busy and have to meet federal and state reporting requirements; providing additional specific data to researchers is not generally one of their priorities. While I contacted all 50 states in this project, only a handful responded to a general survey and only one had the time to provide the data I requested in detail. Instead, the other states provided me with the same report they provide to the EAC, which has limited usefulness for the purposes of this study.

Research Over Time. Another challenge is the difficulty of comparing elections to each other; provisional balloting is still too young a process to accurately discover consistent trends. The November 2, 2004 election was the first election to have national use of provisional ballots and "the application of how and when provisional ballots will be cast and counted varies among the states" (EAC, 2005). Because of the inherently political and social nature of the elections process, no two elections can be said to be the exactly the same and statistical interpretation must be weighed against multiple factors. Therefore, while analysis of provisional statistics here is of interest and use, only time and a revisiting of the numbers against future elections can confirm the conclusions. Similarly, the evaluation of how new technologies impact turnout will be informative, but only long-term study will confirm if the trends discovered will last.

Objectives of the project

In this study I evaluate impact of Electronic Motor Voter (EMV) and Online Voter Registration (OLVR) on the provisional balloting process and the impact of Online Absentee Ballot Request (OAR) and Online Absentee Ballot Delivery (OBD) on the UOCAVA absentee balloting process, and I examine the types of voters who use EMV and OLVR. My focus is on the affect of the solutions implemented in the state of Maryland, where all the aforementioned projects have been developed and where as a technical employee I have access to all the data I require for the study. Additionally, I compare my findings in Maryland to the data found on the EAC reports for Alaska, Arizona, Kansas, Florida, and Wisconsin.

Following are the specific hypotheses I examine:

H1. Gender will not significantly influence the voter's choice to use OLVR

H2. Party will not significantly influence the voter's choice to use OLVR

H3. Age will influence a voter's choice to use OLVR. Specifically, technology will be used more by voters under 30 and less by voters over 65.

H4. Age will not influence a voter's choice to use EMV but will be used equally be all age groups.

H5. Because of the complex nature of elections, the various technical projects will not significantly impact the overall percentage of voter turnout.

H6. EMV and OLVR will reduce the overall percentage of provisional ballots cast.

H7. EMV will reduce the number of provisional ballots rejected due to registration-related problems.

H8. EMV will reduce the number of provisional ballots which are "Accepted in Part" in the jurisdictions that have such a concept.

H9. OLVR will increase the number of polling place ballots cast.

H10. OLVR will increase the percentage of provisional ballots rejected.

H11. OAR will reduce the percentage of absentee ballots rejected for lack of an absentee ballot application.

H12. OAR will increase the turnout of UOCAVA voters.

H13. OBD will reduce transit time of absentee ballots.

H14. OBD will reduce the percentage of ballots rejected for being untimely

H15. OBD will reduce the percentage of ballots never returned.

CHAPTER 2

LITERATURE REVIEW

Turnout Issues

Most literature has focused on ways to improve overall turnout, not on ways to improve provisional and absentee turnout. However, there has been enough research to highlight issues relevant to this study.

College Age Turnout Issues. One specific voter registration concern is young college students, many of whom are temporarily away from their home and are new voters who are unfamiliar with the registration and voting processes. College students have particularly low turnout when compared to other age groups. However, especially in swing states and in places with convenient voter registration, college students do show an interest in voting (Niemi, R., 2010). One study showed that "Students who registered through an on-campus voter registration drive turned out to vote at a higher rate than similar young people nationwide" (Ulbig & Waggener, p544-550). This suggests OLVR may help the youngest voters turn out to vote.

Absentee Research. A search of the academic literature uncovered only one study focused exclusively on absentee voting turnout and the different types of absentee voters. That study itself explained that much of the research on absentee voting as of 2008 had been focused on the difference between the absentee voter and other types of voters (e.g., early voters, polling place voter, nonvoters, etc.) with little study being done on the differences between different types of absentee voters and their return and rejection rates (Alvarez, 2008). In light of that gap, in 2008 Alvarez, Hall and Sinclair published the results of an extensive study of absentee ballots during the 2002 General Election in Los Angeles County, California.

While the authors were careful to caution that a study of only one county for one election may not have the breadth for wide applicability, their research uncovered many of the

same problems suggested by the turnout statistics in Maryland; specifically, they found that "overseas citizens, permanent absentees[9], and those citizens who requested a non-English ballot were substantially less likely to return their absentee ballot" (Alvarez et al, 2008, p681). Further, they found ballots cast by the overseas voters were the most likely to be rejected. The data examined did not contain the reasons for ballot rejections, but the authors speculated that untimeliness was a likely factor, in part because of findings by a 2001 national study on absentees by the General Accounting Office (GAO), which stated that around 40% of all rejected UOCAVA ballots were rejected for untimeliness (Alvarez et al, 2008). That same report explained that delivery of first class mail to UOCAVA voters can take as long as one month (2008). This suggests that in a worst-case scenario, a UOCAVA voter could be mailed an absentee ballot 45 days before an election (in compliance with the recent MOVE Act), the voter could complete and return the ballot on the same day, and the local election would not receive the ballot until 15 days after the election. Unless the jurisdiction allows for that time in their canvassing rules, some UOCAVA voters, through no fault of their own, will automatically have their ballots rejected for being too late.

In addition to the GAO study, the Alvarez study referred to a 2004 study of King County's (Florida) which also highlighted problems regarding return rates and rejection rates of absentee ballots. The King County study also found that overseas ballots were the most likely to have been rejected. Another interesting finding was that no correlation existed between voter political party and absentee ballot return rate or acceptance rate (2008).

The only suggestion the authors made for improving the absentee turnout is the possibility of allowing a longer time (past election day) for overseas voters to return ballots. Other than that, they only recommended further study of absentee issues, both in Los Angeles County and in other jurisdictions, to see if the findings are consistent (Alvarez, 2008).

Another brief study observed that, for the UOCAVA voter, registering to vote can be difficult, as can maintaining communication between the UOCAVA voter and the local election officials. The difficulty managing the election process as a UOCAVA voter causes a

[9] Permanent absentee voters are voters who have indicated to the election board that they are permanently overseas and will require an absentee ballot in every election. Not all jurisdictions permit permanent absentee voters. Maryland is one of the jurisdictions that requires new absentee requests during every election cycle even for voters who are permanently outside the U.S.

significant decrease in voter turnout (Cain, MacDonald, & Murakami, 2008, p2). The MOVE Act attempted to resolve much of these issues, but it is still too early to determine if significant improvement has been made. Cain et al noted that, in part due to the efforts the local boards make to ensure military voters have every opportunity to vote, military voters have typically turned out to vote at a slightly higher rate than the average domestic voter. On the other hand, overseas civilian voters vote at about half the rate (Cain, MacDonald, & Murakami, 2008). It is possible that this statistic may be improved with online services which allow the overseas civilian voter to participate without aggressive interaction by the local election officials.

Government Studies. The Election Assistance Commission (EAC) and Federal Voting Assistance Program (FVAP) are the only sources for nationwide absentee statistics over time. FVAP focuses exclusively on UOCAVA voters, surveying both voters and states, while the EAC has done a state-level nationwide survey since 2004 that includes absentee and provisional data. The Federal Voting Assistance Program exists to make those voters a priority (Cain, MacDonald, & Murakami, 2008, p1). The Election Assistance Commission (EAC) surveys indicate that UOCAVA voters have a significant problem receiving and returning their ballots in a timely fashion, especially in the case of undeliverable ballots, and that they are interested in alternative methods such as fax, e-mail and Internet (Cain, MacDonald, & Murakami, 2008, p1). The surveys by the EAC and FVAP that have highlighted the issues UOCAVA voters face when voting are the motivators behind the recent technology projects various states are pursuing, often with funds provided by FVAP grants.

Provisional Research Provisional voting was required for federal elections by HAVA 2002. The purpose is to allow voters the opportunity to cast a ballot in the event of some kind of problem with the registration record. This allows the voter the opportunity to vote and the election board the opportunity to research and, if appropriate, rectify the error and count the ballot prior to final canvass. However, implementation details are not federally mandated, and so the application of provisional voting varies widely among the states. For example, in the 2004 general election Alaska counted 97% of their provisionals while Delaware counted only 6% (Novakowski, 2008). (However, this statistic fails to explore the reasons for those variables; how much is related to differences in the law and how much due to regional and

demographic differences is not answered in the study.). Novakowski notes the difficulty in determining voter registration status: if a person registered while at the motor vehicle administration but the election board never received the application, would a state accept the notation at the motor vehicle association as sufficient to confirm registration? Or would the form itself need to be found? Differences such as these hamper consistency in the application of the provisional ballot laws (2008).

The literature on provisional voting in elections is sparse; outside of the surveys from the Election Assistance Commission, which are broad in scope and unable to delve into the nuances of the data, little is known about the effectiveness of the tool or if methods of improving voter registration have decreased the need for it. However, in Maryland one of the goals of Electronic Motor Voter and Online Voter Registration was to reduce provisional ballots. The gap of literature on provisional voting highlights the need for studies such as this which can begin to identify problems and solutions for provisional voters.

Voter Registration Demographics

If the results of an election are to be truly representative of the citizens' intent, the demographics of those who turn out to vote should be in ratios statistically equivalent to the ratios of the demographics in the full population. Since in most jurisdictions registration is required in order to vote, ensuring a fair registration process that provides all citizen equal opportunity to register is essential. Therefore, some of the literature has focused on the demographics of those who register to vote; for example, women in elections, who did not have the right to vote in the U.S. until 1920.

The gender gap between men and women in elections moved from a 10% gap (with males voting at a higher rate) in 1948 to what appeared to be a slight increase in female voters by 1980, although in certain regions females still voted at a lower rate (Fullerton and Stern, 2010). By the early twenty first century the role of women in national elections was becoming apparent, with the need for politicians to win the "women's vote" making headline news. According to a 2001 news article by the National Review, President George W. Bush needed only to win a small percentage of the female vote to win. That same article noted that men (particularly white men) were leaving the Democratic Party (O'Beirne, 2001). An article on women voters in Missouri in 2004 discussed similar polling data: women were key to

deciding the presidential election in that state; the challenge there, however, was getting the women registered (Lerner, 2004).

Fullerton and Stern note the importance of controlling for the differences between registration and turnout statistics, since the demographics of those who register may be quite different from the demographic of those who turn out to vote; for example, in their study of voters in South during the 50s and 60s, men registered at a 10% higher rate than women but turned out to vote at only a 4% higher rate (2010). Their study revealed that when men were more likely to be registered to vote (such as during the time of the draft), men turned out to vote at a higher rate. However, registration and turnout participation in their study were driven by different variables, and while women were less likely to register, they were more likely to vote (2010). While Fullerton's paper calls for more study on the different variables in elections, the findings underline the need to ensure equal opportunity in registration, so that all who wish to vote are able to.

A 2008 article in The Nation noted that as local election boards struggled to comply with the new federally mandated voter registration systems and the associated NVRA requirements, some states were removing too many voters while others weren't removing enough. While the author's primary concern was intentional voter suppression, large-scale registration mistakes of the type the federal laws are intended to prevent could, intentionally or not, suppress the vote of certain segments of society, since those with the right knowledge and paperwork to timely fix their own registration problems are likely those with better personal economic situation and higher education (Gumbell, 2008). This again points to the need for equal and accessible registration opportunities for all.

Another article from The Nation cited an interesting statistic: as of 2008 an estimated 1/3 of eligible American voters were not registered to vote (Vanden, 2008). While that article does not cite the source of that statistic, it is in harmony with the turnout numbers from Professor McDonald at George Mason University, who calculates turnout rates for federal election using estimated eligible voting age population (rather than the traditionally used voting age population) as a denominator. His numbers estimate the turnout from 2004 to 2012 as being between 58 and 62% (seeFigure 6). Since so many Americans are not registered to vote, it is vital that those who are registered are actually representative of the general citizenship population in order for an election to be truly representative, and so the

EMV process is expected to be a useful registration process in any state. Evaluating the demographics of registration methods can provide insight into the effectiveness of the current registration processes.

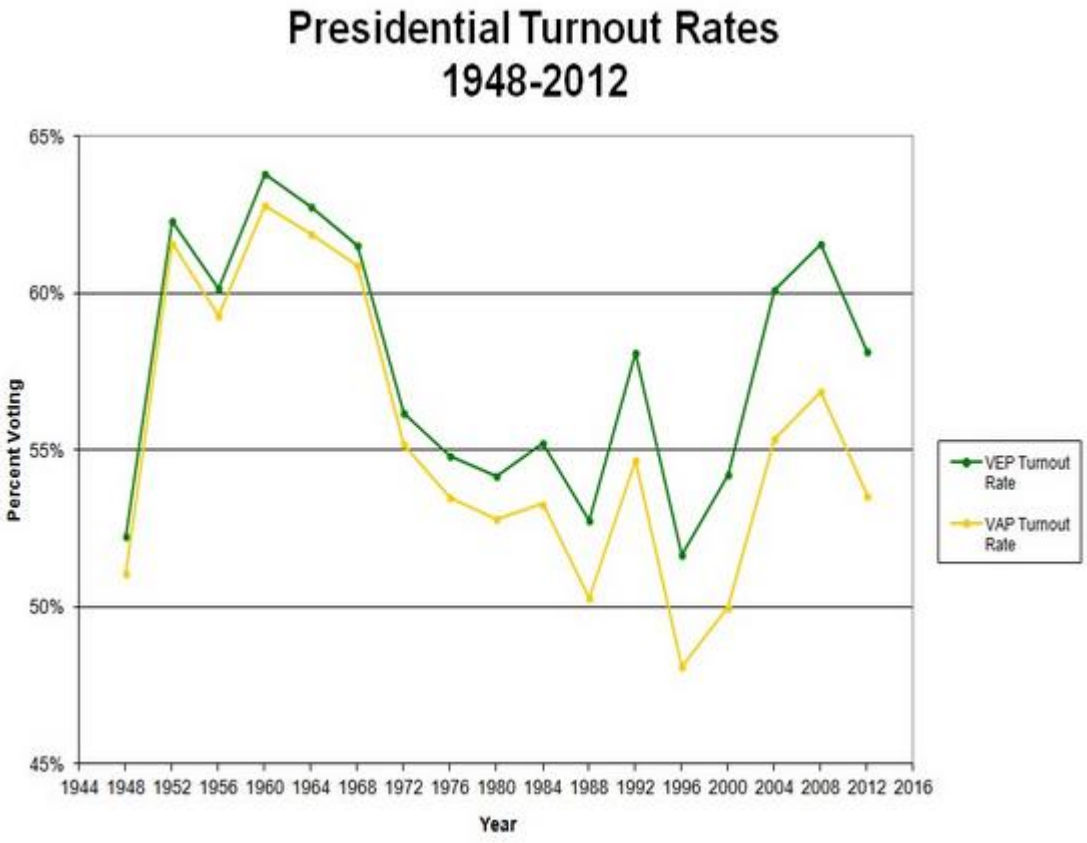

Figure 6 - Presidential Turnout Rates (McDonald, 2013)[10]

OLVR does show promise of being a fair and equitable registration process. Recent studies show an increasing tendency for Americans, particular the young, to use the Internet when participating in the political process; however, no clear indication that Internet use actually changes the level of political involvement in the young. (Foot & Schneider, 2002; Hargittai & Shaw, 2013; Kenski & Stroud, 2006; Smith, 2009; Schlozman et al., 2010; Smith et al., 2009). Hargittai and Shaw's recent study called for more research into the new

[10] VAP refers to the typical denominator for voter turnout: voting age population. VEP refers to Voting Eligible Population. While outside the scope of this paper, it is interesting to note that the increasing discrepancy between voting age population and voting eligible population may explain the perception that voter turnout is decreasing. This phenomenon is one of the primary points highlighted by Professor McDonald's research.

variables influencing political participation, due to their results which showed no link to the previous socioeconomic variables and political participation among the young Internet users, suggesting that the Internet acts an equalizer among differing groups (2013).

Attempts to Improve Turnout

Attempts to increase turnout have usually been based on the idea that the easier it is to register to vote and the more opportunities to vote a voters has, the more likely it is a person will participate. So reforms have tended to center on techniques such as election day registration and voter registration at the Department of Motor Vehicles (Motor Voter), as well as allowing more voting by mail, no-excuse absentee voting, early voting, or election day voter centers (Stein & Vonnahme, 2008). However, with few exceptions "these efforts have not significantly increased voter turnout" (Stein & Vonnahme, 2008, p487). Research supports the idea that political, social and economic factors are more significant influencers on voter participation than any type of election reform (Stein & Vonnahme, 2008). Following are brief descriptions of some of the significant reforms.

Voter Registration Improvements. Prior studies have shown that restrictive voter registration laws decrease voter turnout, but subsequent attempts to make the process easier do not usually cause turnout to increase unless they are significant changes (Hershey, 2009, p87). For example, states where the motor vehicle agencies simply make voter registration forms available see almost no increase in voter turnout, while those where the motor vehicle agency employees actively ask clients to register or even combine the driver's license form with the voter registration form see almost a 4% turnout increase, with the largest increases being among the young and recently moved (Hershey, 2009, p87). This finding suggests that EMV may potentially increase turnout by improving the registration process at the Departments of Motor Vehicles.

The other drastic improvement in voter registration was caused by the HAVA-required statewide management of voter registration. Even as early as 2004 elections showed a reduction of provisional ballots cast and an increase in polling place voters in states with a

statewide voter registration system (EAC, 2005).[11] Similarly, the absentee process improved; "Jurisdictions with statewide voter registration databases reported similar request rates but a higher return rate, suggesting that better administration of registration rolls improved the processing of absentee ballots" (EAC, 2004). This suggests that the improved administration that the various technology projects can bring to elections may bring further improvement to the absentee and provisional processes.

The most recent improvement has been seen in jurisdictions which implement Election Day Registration. "Combining the act of registering and voting lowers voting costs and aligns registration with peaked interest in voting. Scholarly analysis of Election Day registration consistently finds a sizable turnout increase among EDR states" (McDonald, 2008, p491). Some states allow only state transfers of registration on election day, which does result in some modest increase in turnout, but the most increase in turnout is noted when election day registration is available to all (McDonald, 2008, p492). While Election Day registration is not specifically examined in this study, its effects are noticeable in the review of Wisconsin, which has had Election Day registration for decades and as a result does not show in the analysis on provisional ballots.

Vote By Mail. Vote-By-Mail is similar to absentee voting: all voters are mailed a ballot with instructions for completion and possibly information regarding candidates and ballot questions. Oregon State has used vote-by-mail for all voters since 1997 and has seen 80% or better voter turnout since 2000 (Jacoby, 2008, p681). According to Jacoby, the national average turnout in the 2004 election was only 55.3%, while Oregon's was 87% (2008, p682).[12] Vote-By-Mail is a very low-tech solution to turnout problems, reducing issues with election administration to only those related to absentee voting (Alvarez & Hall, 2006,

[11] Too little information exists on provisional balloting prior to implementation on HAVA to state definitively that the reduction in provisional ballots was due to improved registration administration versus a different implementation of provisional voting as a result of the laws. However, it seems likely that as registration records improve, provisional ballots cast would improve.

[12] Note that different researchers use different denominators when determining percent turnout. Therefore, comparing the percentages found within a study is appropriate, but care must be taken if percentages are compared between studies.

p500). Oregon saw an increase in turnout among disabled voters or those with transportation problems, as well as among those who had recently moved, and it appears to significantly improve turnout and voting frequency (Alvarez & Hall, 2006, p500). Similar results have been seen in the United Kingdom (Alvarez & Hall, 2006, p500). Theoretically, privacy[13] may be a concern here, especially for military or nursing home voters, but surveys have been done that imply it has not been an issue to date; similarly, while voter fraud has been raised as a valid question, the incidents of significant fraud are extremely rare (Alvarez & Hall, 2006, p504). While vote-by-mail reduces the number of provisional ballots because polling place related problems, such as mistakes by election workers and voters going to the wrong polling place, are non-issues. However, the UOCAVA related issues inherent in the absentee process is not eliminated by vote-by-mail.

Early Voting. Early voting is an attempt to reduce the inconvenience of voting by providing more opportunities to vote for a period of time before the election. In some states the term "early voting" refers to early voting by mail, but in other states it refer to voting early in person at designated voting locations (Gronke et al, 2007). "The popularity of early voting (Southwell and Burchett 2000) and other forms of convenience voting (i.e., voting by mail) suggests that many voters prefer the convenience afforded by early voting" (Stein & Vonnahme, 2008, p489). An early voting rate of approximately 21% nationwide was reported in 2004 and 2006 (Gronke et al, 2007). However, early voting has done little to improve overall turnout, with convenience voting being used mostly by active voters, not new voters (Gronke et al, 2007) (Stein & Vonnahme, 2008). Early Voting is something used in Maryland, but it is not examined in this report. However, it may be useful to note that when Early Voting was implemented in 2010 in Maryland, provisional ballots began to be accepted in part when voted out of county and not just within county, which explains the significant increase in Accepted in part provisionals between 2008 and 2010 in Figure 1.

[13] Some researchers have speculated on the possibility of military commanding officers or nursing home nurses inappropriately inserting themselves into the voting process when an absentee ballot is used. Alvarez and Hall reported that this has not been a significant issue .

Vote Centers. Some jurisdictions have experimented with vote centers, or large consolidated precincts, on election day. The literature differs on the affect of vote centers on turnout. A study of two local elections in Arizona indicated overall voter turnout increase, particularly among infrequent voters (Stein & Vonnahme, 2008). However, a study by Alvarez and Hall on the recalled 2003 Gubernatorial Election in Los Angeles County, California found the opposite result. Two-thirds of the registered voters had their polling place location changed due to a 64% reduction in the number of polling places. A comparison of the voters who had a polling place change with those who did not showed a drastic reduction in turnout. Alvarez and Hall concluded that "reducing the number of polling places can reduce turnout" and that it also has the potential to increase the number of absentee ballots (2006, p503-504). Unfortunately, besides the research being inconclusive, the concept of vote centers does not resolve the issue of polling place provisional ballots nor does it begin to address absentee related turnout problems.

Technology in Elections

The literature regarding technology and voter turnout is very sparse. In fact, other researchers have commented on it: according to Alvarez and Hall, very little academic research was done on election administration or voting technologies prior to 2000 (2004). As a result of the controversy surrounding the 2000 presidential election, a consortium of researchers gathered to begin the work of researching elections, but most of their work focuses on the voting systems themselves and not on voter registration.

Technology and Age. While this study is not about the voting systems themselves, some research regarding voter age and electronic voting machines is relevant to the discussion of age and Internet voting technologies. A study of the 1998 and 2002 Gubernatorial Elections in Georgia showed that a change to electronic voting machines caused a drop in polling place turnout and an increase in absentee voting among the elderly, the implication being that the oldest age group is mistrustful of computerized technology (Roseman and Stephenson, 2003, 43-44). Roseman and Stephenson did state, however, that the distrust of computers would likely be temporary, dissipating as the voters learn that the voting machines are easy to use

(2003, p46). From this I infer that voter services over the Internet might at first see limited use by the elderly, but over time should gain acceptance.

Internet voting raises concerns regarding privacy and fraud, but the technologies are so new that little research and development has been done and it is not yet possible to confirm the likelihood of infiltration of the systems or falsification of records (Alvarez & Hall, 2006, p504). In 2000 a flurry of interest regarding Internet voting resulted in significant activity: several states ran mock Internet elections; official Internet voting for all voters was used by Arizona in the Democratic primary, but the use was challenged in court; multiple studies were performed by states as well as the U.S. Department of Defense; and other jurisdictions such as California, Florida, and Louisiana determined that it was just too soon to implement Internet voting because of the security concerns (Gibson, 2001, p565-567).

Despite that, Internet voting is espoused by many as a solution that could dramatically increase voter participation, particularly among the younger generation and those who find the physical barriers to voting at the polling place to be insurmountable (Gibson, 2001, p571-572). A survey of Internet users done around 2001 supported this theory, with 63 percent of all responders saying they would vote more often if they could do it online; 74% of those in the 25-34 age bracket said the same (Gibson, 2001, p572). The 2000 Democratic Primary in Arizona confirmed this claim, with a record number of votes being cast, significantly increasing turnout compared to prior elections of the same type; and while turnout among younger voters was still small compared to other age brackets, 75% of those in the 18-24 year old range voted online (Gibson, 2001, p575-576). Despite this success story, there needs to be more research in this area regarding voter demographics, privacy, and security as related to Internet Voting, before it can be adopted systematically. For example, the studies on the Arizona election imply that certain economic and cultural classes were less likely to vote and there is no certainty that the turnout increase would be sustained over time (Gibson, 2001, p575-576).

It is reasonable to assume that the same people who would use the Internet for voting would also use the Internet for other services such as registration and ballot delivery, even if those people are a subset of all those who would use online services other than Internet voting. Therefore, it is relevant to point out a survey of registered voters by Yao, Okoli,

Houston, and Watson, in which those in the 18-24 age range strongly favored remote electronic voting to those in other age brackets, but that gender, income, education and employment were not significant variables. The race variable in that study was inconclusive, possibly because of the small sample size (2006, p42-43). This is an interesting find because historically whether or not a person chooses to vote is impacted by a wide-variety of variables, including race, ethnicity, age, gender, political affiliation, and level of political saavy, with income level and education being the most significant (Tolbert & McNeal, 2003, p1). From this one can infer that Internet services are not likely to change who will turnout to vote, but that among those who already vote, the youngest age group will be more likely to use Internet services. Further, it can be inferred that if any turnout relating to technology is noted, it will be in that youngest age group.

CHAPTER 3

MARYLAND SOFTWARE APPLICATIONS

The Applications

Electronic Motor Voter

During early 2011, the Maryland legislature mandated an automated process of implementing the Federal Motor Voter requirement (Senate Bill 765). While state law required any voter registration application to have a "wet" signature authorizing the voter's acknowledgment of the application oath, state law also allowed a signature provided to one state agency to be accepted at any other state agency. Under that law, the Motor Vehicle Administration (MVA) and the Maryland State Board of Elections (SBE) were authorized to automate the process of voter registration applications at the MVA, provided the MVA also sent the signature for each voter to SBE. The MVA and SBE designed a solution that would allow the MVA to determine if a client was already a registered voter, so that the MVA could provide the opportunity for either a registration update or a new voter registration application. The solution was originally implemented, on February 21, 2012, for the touch screens available to clients obtaining or renewing driver's licenses at the counter at local MVA branches (see Screenshots for Motor Votor); by November of 2012 the same screens were made available to voters renewing their driver's licenses at self-serve kiosks or online.

Online Voter Registration

During early 2011, the Maryland legislature authorized SBE to participate in ERIC, a cross-state information sharing endeavor (Senate Bill 765). Participation in ERIC required online voter registration, so a law was added to permit OLVR for voters as long as they could provide a valid driver's license number or MVA ID number for which the MVA could provide a signature. An exception was made for UOCAVA voters, allowing the four digit social security number to be used in lieu of a signature, since UOCAVA voters benefit the most from an OLVR system and would be the least likely to have a valid MVA ID number.

While the law gave the MVA an extended period of time for providing the signatures, OLVR was developed to validate a voter's ID and obtain the signature from the MVA at the moment of the application. OLVR went live on July 9, 2012 with the original legal requirement of validation using drivers license number only for domestic, non-military voters and either drivers license or the last four digits of the SSN for UOCAVA voters. However, while SBE employees were aware that a Maryland MVA ID number was generated using date of birth and last name, they were unaware that the algorithm was commonly known and that websites were available that would generate the ID numbers. While SBE was made aware of this weakness shortly before the November election, no tighter data requirements could be made to the original system because of the specificity of the law. By June of 2013 Maryland law had been updated and OLVR had been updated accordingly to also require for domestic voters the driver's license issue date and the last four digits of the SSN for any driver's license validations.

Online Absentee Ballot Request

During initial specification and design of online voter registration, Maryland SBE decided to propose OAR for UOCAVA voters during application for the FVAP EASE grant. Once notification of grant receipt was provided, a step was added to the OLVR application prompting UOCAVA voters to specify the delivery method and address for their absentee ballot. During the 2013 legislative session, online absentee ballot request was mandated for all voters and as of the time of this writing SBE was in the process of implementing that option as a step of the Domestic OLVR application.

Online Ballot Delivery

Maryland began using online blank ballot delivery during the primary of 2010, making ballots available for online pickup to any voter who requested that a ballot be sent via email. The system was integrated with the voter lookup site, which voters could use to look up their registration information and assigned polling place. The system was in cooperation with the University of Maryland in College Park and was very successful at delivering blank, PDF ballots and associated documentation. Feedback from voters was positive, although

duplication of ballots by the local board was a challenge.[14] For budgetary reasons, Maryland had decided to bring the voter and polling place lookup sites in-house by July 1, 2012. Since the OBD system integrated with that voter lookup site, that meant OBD would be brought in-house as well. Therefore, when work on OLVR began, a redesign of OBD began as well. As part of that redesign, a ballot marking wizard was included in OBD and additional software created for the local boards to use for duplication of ballots during canvassing. The ballot marking wizard stored pixel positions, page numbers, and ballot style information in a QR Barcode printed on the left-hand corner of the ballot. The ballot duplication software parsed the value from the barcode and used it to select the appropriate PDF ballot and fill in the ovals of the ballot as well as to type in any write-in values. The final PDF could be printed on the appropriate paper, reviewed by the canvassing team, and sent through the voting system optical scan equipment. The new version of OBD was available by 46 days before the election in November of 2012 and the ballot duplication software was available to the local boards in time for canvass.

The Funding

In 2011 the Federal Voting Assistance Program offered grants, known as the EASE grant, to states who wished to improve the UOCAVA voter experience through the development of programs such as Online Absentee Ballot Request, Online Voter Registration, and Online Ballot Wizards. Maryland submitted a proposal and won one of the awards, which paid for a significant portion of OLVR and all of OBD. Part of Maryland's proposal was that development would be in-house and that the resulting code would be available to any other state or local jurisdiction which wanted it in the future. In large part due to the choice to keep web development and database management in-house, all the applications mentioned here, as well as the redesign of Maryland's voter and polling place lookup sites, were implemented for less than $500,000 and are maintained for less than $250,000 a year.

[14] Because of the strict certification requirements for systems which count votes, all systems as of 2012 required ballots being scanned to be on the right paper, which was generally longer, heavier, and printed closer to the margins than normal paper. Therefore, any ballot printed out by a voter onto had to be duplicated onto a scannable ballot before it could be counted. This was an issue common to all jurisdictions and voting systems, not a specific Maryland issue.

The Team

Implementing the various applications required a large team of SBE employees, MVA employees, and outside vendors. SBE project sponsors worked with legal authorities during the first half of 2011 in order to get permission for the projects, SBE fiscal employees and project managers worked with funding authorities and the FVAP during the summer and early fall of 2011 to obtain needed budget approvals, and SBE project and contract managers worked with vendors during the end of 2011 and through mid 2012 to procure all necessary services, software, and hardware. Vendors with long-term commitments to the projects included the MDVOTERS hosting company, the Sidus Group and subcontracter Gantech, and the MDVOTERS software development company, The Canton Group and subcontractor Elections, Systems, and Software (ES&S). I was the SBE employee responsible for all in-house database administration and development and was part of the SBE team that developed specifications. Because the amount of development necessary was too great to complete alone in the time frame allotted, I also supervised an outside consultant who did the major portion of the development for the Online Ballot Wizard.

The Network

Because Maryland's voter registration system (MDVOTERS) was hosted in a private network isolated from all outside access, an entirely new network had to be designed to host the new applications. The network needed to be able to allow Web access for both the various Web applications and an SFTP server, but it also needed to be able to network with the MDVOTERS database for data transfer purposes without compromising the security of the voter registration system. In order for OLVR records to be validated with the MVA at the moment of the application, the OLVR network also needed to have at least one server be part of Network Maryland, the Maryland statewide network operated by the Maryland Department of Information Technology.

The final solution was a privately hosted VMWare based cloud, which used blade servers to minimize the required space and energy. This solution allowed the SBE the flexibility of creating initial server configurations that could be altered later as the requirements of the various applications evolved. The initial production network architecture

included a Web server, an Application Server, a Database Server, an Server dedicated to validating OLVR records with the MVA, and FTP Server, in addition to the Cloud Management server, a backup server, and appropriate zones to protect sensitive information from outside access. The cloud was hosted with the same vendor which hosted MDVOTERS, allowing the servers to be stored in the same cage and connected with a physical line for data transfer purposes. The private cloud was available by January of 2012.

The Data Exchange Process

A visual overview of the data flow of the applications describe here is available in Appendix D -. While other data flow is managed on the OLVR network, only the relevant portions are included in the diagram. Following is a brief description of the data exchanges represented on that diagram.

SBE provided MVA with an initial voter registration list and then on a nightly basis the OLVR application server ran middleware which created nightly updates to that list and placed them on the MVA's SFTP Server. The MVA in turn placed on their SFTP server a text file containing all VRAs from the day and individual bitmap signatures for each application. Middleware running on the OLVR application server retrieved those files and loaded them into the OLVR database in preprocessing tables.

The MVA made a web-service available over Network Maryland that the OLVR application used for validating driver's licenses and obtaining the byte array of the signature. The MVA provided the signature in a compressed TIFF format. The OLVR application saved all signatures and applications in the same preprocessing tables as the EMV data.

On a nightly basis the OLVR application server ran a batch processing job which transformed the data in the preprocessing tables into the format agreed upon by SBE and the MDVOTERS software vendor and saved the transformed data into the table from which the MDVOTERS middleware would later retrieve the records.

On a nightly basis the OLVR database server initiated a connection with the MDVOTERS database in order to update the voter, absentee, and street data required by the various applications. The connection was closed immediately after the data transfer was complete. Some of the required absentee data was uploaded manually after an extract from MDVOTERS was pulled using the user interface.

On a nightly basis, the MDVOTERS database initiated a connection with the OLVR database in order to retrieve prepared records waiting in the agreed upon table. The connection was closed as soon as the data transfer was complete.

The Software

The MDVOTERS software vendor had to make changes to the batch processing module in order of the local election boards to process VRAs submitted from the MDVOTERS system and the OLVR system. Originally all VRA batches were created by scanning the paper into MDVOTERS, but the new batches were created by middleware which retrieved the data and images from the OLVR database. While the scanned-in batches simply allowed the data entry clerk to see the image while manually entering each piece of data, the auto-generated batches displayed the image and the data, requiring the data entry clerk only to verify and edit where appropriate. A flawless VRA required no more than tabbing through the identification and address fields in order to trigger duplicate, felon, and deceased checks as well as confirm the validity of the residential address. A VRA with an absentee ballot request attached required a few additional steps, displaying the absentee request for visual confirmation that all data was correct. From a data entry perspective only, the new batch processing module could save up to a minute of data entry time for each VRA. (However, not all VRAs were flawless. See the section on The Lessons Learned.)

As the SBE developer, I wrote both middleware and web software. The middleware was a combination of database scripts and .Net console applications, scheduled with either SQL Server Agent on the application server or with the database's internal scheduling tools. The web applications were written in .Net, using ASP.Net Webforms. The web applications were reviewed for adherence to accessibility standards by an outside vendor and all web applications were made available in both English and Spanish.

The Security

Network Security

The necessary network security was managed by the host vendor, and it included such standard security measures as removing all server "guest" accounts, preventing all access to

the Web Server and SFTP server except on designated ports, limiting connection in-network to only the necessary ports, and setting the connection between the OLVR database and MDVOTERS to only allow a single port. Security was further tightened by limiting access for the test version of the applications to only specific IP addresses in addition to requiring user name and password logins. The OLVR application server became the central processing unit for processing data to and from the OLVR database and for management of the other servers, but outside access to that server was eliminated except for system and database administrators over specific ports.

Data Security While the most critical security measures in any system are taken at the server level itself, protection of data during exchanges between systems and during Web application use is also important to ensure as secure a system as possible. Standard measures, such as preventing SQL Injection through the use of static database stored procedure and appropriate variable validations, were part of the security items originally implemented. Database passwords were also changed at regular intervals. All attempts to validate at the MVA were logged by both SBE and MVA, whether the attempts were successful or not. By June of 2013 logging of additional information had been added to every OLVR transaction so that suspicious transactions, if any, could be more easily identified.

Online ballot delivery had additional security added: every voter was issued a GUID as a password, every login attempt was logged, and voters were logged out after a specified number of failed login attempts. Those voters had to contact SBE, instead of the local boards, in order to have their accounts unlocked, so that any suspicious activity could be more easily identified.

Both OLVR and Online Ballot Delivery made use of timeouts for inactive sessions and the Web Server application pool was reset at regular intervals.

The system's security was reviewed by a security consultant and validated through penetration testing which was unable to gain access to the servers or the data.

The Lessons Learned

Each system had its own strengths and weakness, and during the initial implementation the SBE employees paid close attention to phone calls from voters and local

election boards in order to gauge the success of the systems (defining success in terms of high voter satisfaction and low frustration on the part of the local and state board employees). Following is a summary of the lessons learned by SBE employees after implementation of the various projects.

Online Ballot Delivery, being only a redesign of an already existing system, was by far the most successful. It was used by a more limited audience, one which was already accustomed to the ballot download tool, was excited by the prospect of a ballot wizard, and expressed high customer satisfaction in the follow-up survey by the Overseas Vote Foundation (2013) The main struggle with that application was related to zip codes: some overseas voters were not sure which zip code to use when logging into the system, and lock outs occurred more frequently than had been expected. However, one of the great successes was that in the event a voter struggled with the system, our staff members could login and save the blank ballot and documents and email them to the voter (which was the form of electronic ballot delivery used prior to the implementation of OBD in 2010). This simplified the task of gathering all the needed documents for those voters who needed more assistance and improved accuracy because the system – not an individual – generated the documents for each voter. While strict records were not kept of this process, based on the number of downloaded ballots saved by the two users who performed this task, SBE estimated that less than 300 voters needed this level of assistance. Nearly all voters who attempted to use OBD were successful.

Online Voter Registration was nearly as successful: most voters were able to submit applications without difficulty and many verbal compliments were received by those who answered the phones. The Overseas Vote Foundation also did a survey which found positive feedback on OLVR from UOCAVA voters (2013). The local boards had few problems with the transmitted OLVR batches from domestic voters; data entry problems seemed to be quite low. However some technical and usability issues did exist that caused frustration for some voters. The biggest complaint was in address validation. Because the application would not allow a voter to submit an application without an address that validated against the official street records, any difficulties with validation would frustrate the voter. Problems with the algorithm for validation prevented some voters from using the system at all. Between implementation in July and the close of registration for the November election, 3 patches went

in to improve the validation algorithm, and by the end of the time period very few voters still had difficulties.

Another problem with OLVR was that in the first implementation a bug in the code would revalidate a voter against the MVA repeatedly, even after receiving a positive result. This created problems with the MVA network and the OLVR system and an emergency patch went in to resolve this prior to the election. However, even after the patch, the total time required for 1) sending data to the MVA for verification 2) retrieval of the signature by the MVA 3) return of the signature to OLVR, and 4) saving of the signature in the OLVR database took longer than expected. While under normal circumstances this caused no problem, on the close of registration when up to 50 signatures a minute were being validated, a backlog occurred and some voters reportedly waited up to 10 minutes for validation. Over 11,000 records were received that day by the official close at 9PM.

Both the MVA and SBE patched their systems during 2013 with the goal of being able to handle an increased number of simultaneous connections. On SBE's side some of the steps included 1) changing the primary key on the signatures table so that the save routine could be changed from a merge to an insert and 2) removing redo log generation on the signature table (because a lost signature could simply be retrieved from the MVA at a later date) 3)improving archiving processes so that the overall number of records in the signature table was greatly reduced, allowing for faster inserts and 4)increasing the frequency in which statistics were generated on the table. Also, improvements were made to the process by which OLVR retrieved the signature from the MVA. The impact of those improvements was promising, but as of this writing, extensive load testing had not been performed.

Online Absentee Request, as part of OLVR, was also quite successful from the voter perspective. However, the local election boards had some difficulties with these records that they did not have with OLVR. The biggest problem was that processing absentee ballot request as part of the voter registration batch data entry process was completely new to the software. Therefore, despite thorough testing by the SBE, some software bugs remained and any frustrations during data entry of OLVR batches were always about the UOCAVA batches with the absentee ballot requests. Occasionally, I had to go to the database and retrieve the voter registration application and associated absentee request and send it manually to the local election board for processing because the record was unable to be processed in batch. While

these problems were rare, the loss of even one registration or ballot request is considered a failure by members of the state and local boards in Maryland, so frustrations were high in this area. The software vendor and the SBE voter registration staff worked diligently to discover and patch the problem, and as of the time of this report testers believed it to be completely resolved.

EMV VRAs were the records that became the subject of the most "lessons learned" conversations. The single biggest complaint from local elections boards was the sheer quantity of the records. When initially implemented, the MVA provided approximately 3000 VRAs every night, far more than initially estimated. This is because while new voters were provided with the opportunity to "opt out" of a voter registration application, those who were found to already be voters could only opt out by choosing "no" on the last page, when the voter was asked to confirm that the prior pages were true. Since most voters clicked yes, even when they had clicked "no" to updating name and address information, a VRA would still be sent to the local board, but that VRA would contain only old information or be an exact duplicate to an existing application. While the MVA resolved this in 2013, in the months leading up to the election the quantity of applications was overwhelming to the local boards, especially because that is already the heaviest voter registration period of the busiest election cycle.

The MVA attempted to match customers to existing voters and occasionally the result was invalid. The most common cause of this was a fuzzy match algorithm, which located potential voter matches based on partial name matching with date of birth. This problem only occurred due to a miscommunication between the MVA and SBE technical teams; the SBE team members were unaware of the limitations of the MVA touch screen system and had thought the voter would be able to make a selection indicating "no, this is not really me." Once SBE became aware of this step was not possible, the two teams agreed to eliminate the fuzzy match altogether. After that match was eliminated, the only continuing mismatch occurred when either the MVA or SBE had a clerical error on either the driver's license number or the Social Security number. At the time of this writing, no additional software solution was proposed: those very rare records were managed with a manual process that included correcting whichever system had a clerical error and manually fixing the VRA.

However, if two records had been mistakenly merged and not caught before the precinct register pull[15], one of the two voters would have had to vote provisionally.

Another problem with MVA data was the fact that MVA did not use the residential street addresses and the differences in address rules and parsing mechanism meant some VRAs contained only a Post Office Box with no residence. If this was an existing voter the local board had to leave the batch, look up the existing record, and return to the batch to manually fix the address. A similar problem was that the MVA did not provide mailing addresses in the nightly VRAs, and if a person had a mailing address in the system before, the update from the MVA would remove it. While relatively uncommon in the data, with so many records coming through it still felt like a lot of problem records to the state and local election boards. While the source of these problems were still unresolved as of the writing of this paper, SBE decided on a work-around: on the image I created every night containing all the VRA information, I included a section with previous name, address, mailing address, and party. This way, the person doing data entry would not have to leave the batch to research the accuracy of the data from the MVA; instead, all the information they needed would be on the screen. Most of this work-around was implemented prior to the election.

During the period from March 2012 to June 2012 there were also many middleware problems, with the transfer of signatures failing, loads into MDVOTERS taking an unworkable amount of time, batches being created incorrectly and requiring reloads, etc. The result was that local boards were rushed and overloaded in trying to finish the work; however, they still completed data entry by the precinct register pull, except for a small number of applications that got stuck in the load process and not discovered and added to MDVOTERS until during canvass, when research on provisional ballots uncovered them. Those few records were able to be accepted-in-full provisional ballots because the application was discovered and was timely.

The local and state boards did not have hard numbers with which they evaluated the effectiveness of the MVA batches; it was based on their general impressions of the amount of time needed to process records, the number of problems that had to be fixed, and phone calls

[15] The precinct register pull is when the election officials generate the official list of eligible voters for the election.

from voters with complaints. The general impression was that when the system worked, it worked incredibly well. Records could be processed far faster than paper applications could be and instead of paper being lost in transit from the MVA applications moved smoothly into the voter registration system. However, when things were buggy, the applications took far longer to process than paper, some applications simply never made it into MDVOTERS, some were updated with outdated or incorrect information, and in rare cases voters were incorrectly merged, due to the matching problems. SBE developed work-arounds, running reports to locate records with name and address changes for manual review, adding (as noted previously) helpful information to images, and manually retrieving images whenever possible.

The local board employees expressed to SBE that they believed the number of provisional ballots was the fault of the MVA records and thus they were frustrated with the amount of work these batches generated. However, SBE employees felt that the MVA process improved voter registration and the provisional ballot process. The SBE voter registration team noted that the local boards were able to process far more applications during the 2012 General election cycle than in the 2008 General Election cycle with less assistance from SBE and without any counties requiring an extension on the time allotted for data entry.[16]

SBE employees also fielded phone calls after the close of registration from voters who never received their voter notification card or from voters who had to vote provisionally during Early Voting or on Election Day when they expected, due to MVA registration, to be able to vote on the machines. While in prior elections nothing could be done if a registration had not been received for a voter who claimed to have registered at the MVA, during 2012 the MVA database, the OLVR database, and MDVOTERS could be searched in order to see what prevented the registration from being processed. In some cases the MVA database may have flagged them as a nonvoter. In other cases, something failed in the data transfer process or data entry process and the missing VRA would be able to be located. In those cases, the VRA was entered and appropriately backdated. As long as the VRA was located prior to the morning of the last day of canvass (10 days after the election), the provisional ballot could be

[16] Prince George's County had historically high turnout in the 2008 General election and was unable to finish data entry by the scheduled precinct register pull. A supplemental register was issued for their county only. This was not necessary in 2012 despite the huge numbers of MVA applications.

counted. I ran reports daily during canvass of provisional ballot applications in MDVOTERS to find any which had been flagged for rejected due to nonregistration. If the provisional ballot application data could be matched against an unprocessed VRA in MDVOTERS, someone at SBE notified the local board to process the VRA and accepted the ballot.

Overall, therefore, the reviews of the MVA process were initially mixed, with the LBE employees feeling that it added too much unnecessary work and SBE employees feeling that it improved voter registration records and assisted in locating problems during the Election. SBE employees also believed that some of the provisional ballots could have been a result of the many petitions[17] during that election cycle, as well as Congressional redistricting. Improvements were made to the process by the MVA and SBE and the MDVOTERS developers and DBA so that the bulk of the problems were eliminated for future batches. While the effectiveness of those changes cannot be determined as of the writing of this paper, this research project is intended in part to determine if Electronic Motor Voter records were helpful or problematic for the management of the provisional turnout in the 2012 General Election.

[17] In Maryland a change of address on a petition is the same as submitting a change of address on a VRA. However, phone calls from confused voters proved that many voters were unaware of that and had used invalid addresses on petitions.

CHAPTER 4

RESEARCH METHODOLOGY

Data Collection

Because most of the data used in this study was for Maryland, the majority of the data came from the Maryland voter registration system. As part of my job duties as database specialist at SBE, I prepared a variety of queries to fulfill data requests for the usual post-election reports in the first month after the election. The results were reviewed by SBE auditors before being made publically available so that changes could be made to queries and/or the final data when inaccuracies were noticed. The reports included the EAC post-election survey and official turnout, as well as reports on absentee ballot transit time and counts of absentees sent and returned by ballot issue method.

The EAC post-election survey[18] was initially prepared in November of 2012, immediately after certification of the election in MDVOTERS. The SBE auditors reviewed the data until March, working with the local boards to ensure accuracy and making corrections where needed. While the EAC report could be updated when the local boards discovered data entry errors and the voter history data for that individual voter could be edited, it was not possible to fix the tables from which the original report was created. Therefore, whenever possible I used the EAC aggregates for data on provisional, absentee, and turnout counts because SBE is confident in the accuracy of that data.

The report on absentee transit days was created by counting the number of days between the data in the voter registration system indicated the date the ballot was sent and the date the ballot was received by the election board. In reality, the transit days may have been shorter than what the data indicates, because the local board may not have logged receipt on the same day the ballot was received; however, this discrepancy should be the same regardless

[18] The 2012 Maryland EAC report is publically available at http://elections.state.md.us/elections/2012/turnout/index.html

of the method by which the absentee ballot was sent and therefore comparison between ballot delivery methods should still be valid. For this analysis I excluded ballots which showed a negative number of ballot transit days, which can occur if the ballot was not marked sent on the day it was sent out and the sent date was updated on the day of certification instead.

The report on absentee ballots sent by issue method counted all UOCAVA (not FWAB) ballots sent and returned by county and ballot issue method. Because the number of ballots sent by fax or in-person is insignificant (26 out of 17063), I counted those ballots in the "Mail" category.

After the SBE auditors have completed their review of EAC data and have received all voter credit corrections from the local boards, the data is provided to me for preparation of official turnout results, which are available on the web at http://elections.state.md.us/elections/2012/turnout/general/Index.html. While no two data sources for turnout in Maryland are identical, the turnout is finalized when the differences between the data sources is insignificant. In May of 2013 the final turnout numbers were posted because they were less than 500 voters statewide different when compared to any other of the data sources. For purposes of this report, I extracted the voter registration number so that I could match it to the voter registration numbers of those who registered during the sample time period and determine if registrants from a particular registration method are more likely to turn out to vote. Data from the precinct register was also pulled but in the end was not used for this analysis.

In addition to the above data, custom queries were necessary to collect information on voter registration, provisionals, and absentee ballot requests. To obtain specifics about provisional voters, I used the official turnout table, in which I had stored a link to the original provisional ballot. By linking the two tables I was able to query the provisional ballot status and status reason associated with that voter. As noted previously, some discrepancies between data sources do exist: most notably, not every provisional ballot can be linked to a voter because while usually a provisional ballot is treated as a voter registration application, voters who provide an out-of-state address on the provisional ballot are not entered into the voter registration system. Also, if a provisional ballot application is not entered into the voter registration system before the books are reopened it is not possible to add one. Therefore, some voters with provisional credit could not be linked to a provisional ballot in my query.

However, the differences were negligible; the query result was only 73 records lower than the official EAC data.

Absentee requests by request method were queried from the voter registration system, in the absentee request table. The counts did not exactly match that in the EAC data, but it was the only way to collect the data. The query included voter id, request method, request date, date the ballot was sent, and date the voted ballot was received by the local election board.

The report Maryland provides to the EAC includes aggregates of the total voter registration records received by source of registration. However, the monthly statistical report upon which that data is based does not count "pieces of paper"; it counts transactions. In addition to new registrations and exact duplicate registration, name changes, address changes, and party changes all count as a transaction in the given categories. Obviously, a person can update their registration, providing a change to name, address and party simultaneously. So while that is a single piece of paper (or a single online voter registration application), it is counted three times in the monthly statistical report. Also, the monthly statistical report does not distinguish between voter registration sources for in-county moves, which is known to be a category of voters that is represented in provisional turnout. Furthermore, the EAC report counts data starting with the opening of registration after the 2010 General Election through the closing of registration before the 2012 General Election, but OLVR was only made available in Maryland as of July 2012; therefore, EAC data would be misrepresentative of the actual percentage of registrations that came through OLVR versus other methods. Finally, to confirm the value of OLVR and EMV required voter-specific knowledge; for example, how many voters who registered using OLVR had to vote provisionally? This data would not be available at an aggregate level using the EAC report.

Therefore, I created my own query to identify all voter registration applications (VRAs), both new and updated; I queried the audit log in the voter registration database for all transactions between July 1, 2012 and November 16, 2012[19] which were of the following

[19] The close of registration for the November election in Maryland was October 16, 2012. At that point, voter registration is officially closed and the business process is to hold any untimely registrations until after canvass is complete, which was November 16, 2012. I included the full time-period in order to capture timely registration that were not included in the database in time for the voter to be on the precinct register pull. Later

types: exact duplicates, new voter records, and changes to name, date of birth, gender, party, or address. I excluded records which had a source of change of "correction" or other similar types that would indicate the source was not a voter registration application. I did include petitions as a source of change, because updates to an address on a petition are treated as a voter registration application in Maryland. After identifying the transactions, I collapsed them into a single record representing any/all of the above changes on a single day from a single source for a single voter.

To confirm the validity of the results, I calculated the expected number of VRAs from the nightly EMV process. During the time of my sample, the MVA process provided approximately 3000 records each night Monday through Friday (including new, updates, and exact duplicates) and around 1800 on Saturday nights. The nightly amount could be plus or minus around 300 records. At that rate I expected approximately 300,000 records, plus or minus, during the time period identified. My query identified 290,883 records; therefore, I considered the results to be reliable. I used this query to retrieve voter registration number, registration source[20], and county, gender, age[21] as of the November election, party and status[22] as of the time of that VRA.

Census Data

Some analysis required the 2010 Census Data, which is available online at http://quickfacts.census.gov/qfd/download_data.html. When population numbers were used, I used the columns on estimated 2012 resident population. Data such as median income,

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research suggested this may not have been necessary; however, tests of the results reveal no changes to overall registration source ratios.

[20] The Maryland voter data refers to a source of registration, which is the initial voter record registration source, and source of change for the registration source of the most recent update. Because I was able to identify VRAs, throughout the rest of this paper "registration source" refers to the source of that specific VRA and not necessarily to either the Maryland source of registration or source of change as reflected on the current voter record.

[21] 24 MVA Records, 2 OLVR records, and 445 Other records show with an unknown age when grouping by age. Those are included in the counts by party and gender and in all the totals, but excluded from the specific age groups.

[22] All VRAs are included in the analyses of registration statistics, regardless of original or current status.

females in the population, population over 65, etc. came from the census data and was linked to the EAC data using FIPS code.

Data from Other States

To see if the results of my Maryland analysis were unique to Maryland or if they might have more wide-spread application, I collected data from five other states: Alaska, Arizona, Florida, Kansas, and Wisconsin. They provided me with their EAC spreadsheet for the November 2012 election. While this data did not provide the detail necessary for a voter-level analysis such as I was able to do in Maryland, it did provide enough data to confirm some general trends in the use of OLVR and EMV and the corresponding impact on provisional voting.

They also completed a survey which gave information on if and when they had implemented the technological projects under review in Maryland. Wisconsin is an NVRA exempt state which offers no Internet or Motor Voter registration because they offer Election Day registration; Alaska does have normal Motor Voter registration but does not have an EMV or OLVR application; Florida has EMV only; Kansas has EMV and also implemented OLVR in 2009; and Arizona has EMV and also implemented OLVR in 2001. Alaska, Arizona, and Kansas are similar to Maryland in their administration of provisional ballots (they are offered to all voters and counted in full if the voter is determined to have been registered on time and in the precinct in which they voted). This allowed for a comparison of how provisional turnout may be affected by EMV and OLVR projects.

Data Analysis

After the initial data collection, I used Microsoft Access to transform the data into the desired format and join different record sets together using voter ID. I used Microsoft Excel to calculate appropriate percentages. Most analyses used percentages so that different counties could be compared to one another; for example, I tested Internet VRAs using the percentage of all VRAs that were from the Internet, rather than using the raw count. Graphs displaying statewide percentages were created in Microsoft Excel. Finally, I used MiniTab 16 to analyze the spreadsheets and determine the significance, if any, of the findings.

In addition to the visual aid of scatterplots, I used MiniTab's regression analysis test to determine the validity of perceived correlations. In addition to the visual individual value

plots, I used the Anderson-Darling normality test to determine the normality of a given data set and then chose the appropriate test for significance: either the two-sample t-test for normal distributions or the Mann-Whitney test for nonnormal distributions. When choosing to display either mean or median on the Individual Value plots, I first tested for normality using the Anderson-Darling Normality test, and then displayed median for nonnormal distributions and mean for normal distributions.

To determine the significance of a regression equation, I was most concerned with the p-value and the r-squared value. For example, running a regression analysis with median income as the predictor and the percentage of Internet VRAs as the response is actually testing the hypothesis that median income has no impact on the percentage of Internet VRAs. A p-value higher than .05 indicates that the data does not support the rejection of that hypothesis. Therefore, I rejected the perceived correlation for any regression analysis showing a p-value greater than .05; however, even if the p-value was less than .05, I considered any equation with a low r-squared value too weak to be meaningful, because the r-squared value represents the variances of the values; the higher the r-squared value, the closer to the regression the line the values fall.

The percentages for demographics were calculated by looking at the distribution of party within each source and then comparing those distributions to one another. This was to account for the fact that OLVR is a lower percentage of all applications and thus would likely always show as the smallest use within each demographic. A good visual of this is Figure 7, which shows both the expected decrease in registrations with age and the fact that OLVR received a much smaller number of registrations. Looking outside the sample time period at the first 6 months of 2013, statewide Maryland may receive 100 OLVR VRAs on a given night along with 2600 MVA VRAs.

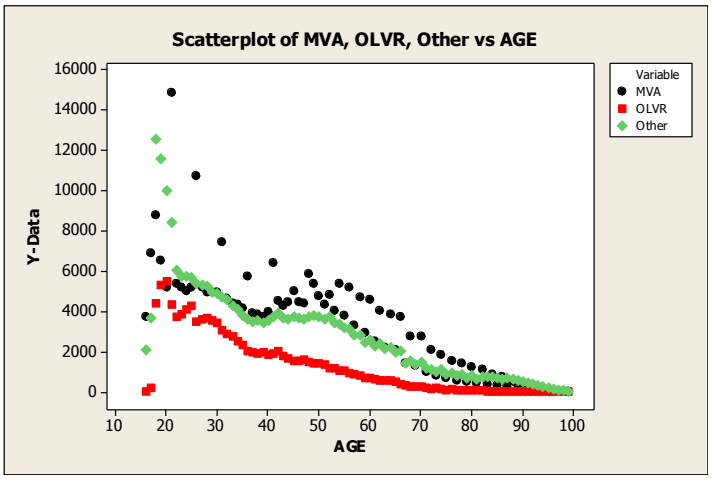


Figure 7 - Counts of VRAs by Age and Source

In order to determine the statistical significance of the differences of various demographics within the registration methods, I ran paired statistical tests in Minitab 16. If the distribution of both variables passed the Anderson-Darling normality test with a p-value of less than .05, I used the Two-Sample T-Test. If either distribution did not pass the Normality test, I used the Mann-Whitney U test instead. In either case, I set the alternate hypothesis based on the visual representation of the values in an individual value plot.

The biggest flaw in this analysis is the small dataset – everything was done at the county level, and Maryland has only 24 counties. Eliminating Queen Anne's county for data problems means all analyses were run using a dataset size of 23 rows. Future analysis at the precinct level or even at the Legislative district level could provide more precise results.

Initial Data Tests

As an additional test of the validity of the data, I ran correlation tests against Census data to see if either the EAC and or the custom query followed any obvious patterns. Since the literature review showed that data elements such as median income or education correlate to voter turnout, I expected the more valid dataset to follow that same trend. To calculate the percentage of Internet VRAs according to the EAC report, I used the total number of voter registration applications received, including provisional ballot applications, and used that as

the denominator.[23] Figure 8 shows a scatterplot with median income[24] as the predictor for both my query count and the EAC count. The most obvious findings are that the percentage of OLVR applications is lower in the EAC data and the variance among the counties is larger.

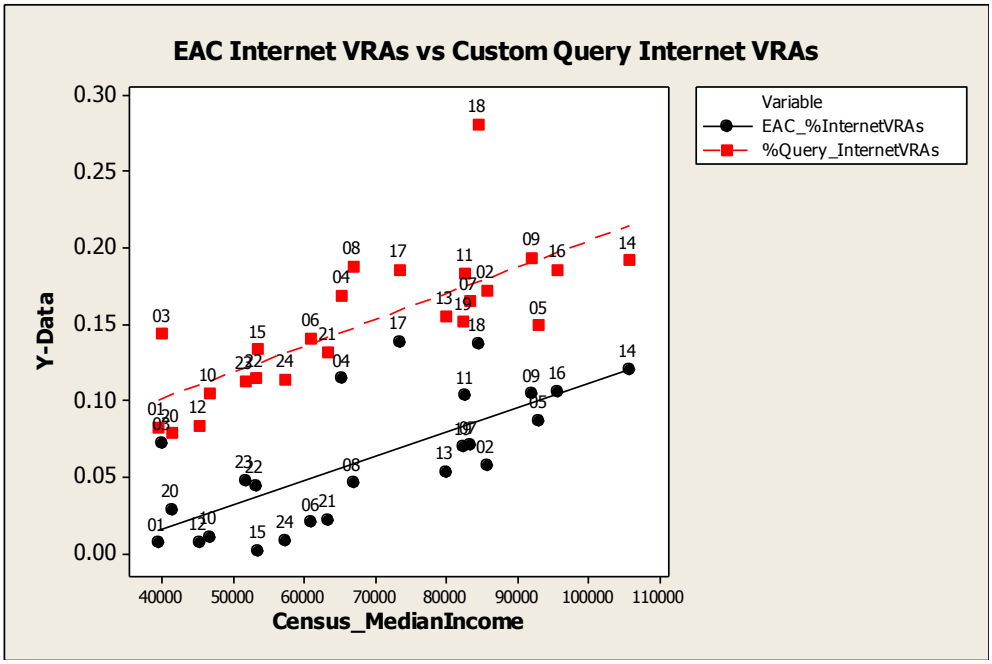


Figure 8 – Maryland: Median Income and Internet Voter Registration Applications

The other finding is that in both the EAC data and my query data, Queen Anne's county (county 18) has an unusually high percentage of Internet VRAs (around 5-10% higher than expected), although it is a clear outlier in my query and not in the EAC data. I then audited a random sample of Queen Anne's "OLVR" records in the voter registration system. Over 50% of the audited records showed that data entry clerks had erroneously applied the OLVR source of change to records which had no VRA from the OLVR system. Therefore, I excluded Queen Anne's county from further analysis and reran the plot. Median income shows a much cleaner and reliable correlation with Internet VRAs from my custom query

[23] The provisional ballot section excludes provisional ballot applications from the "other" category of registrations, but all other sections include them.

[24] Median income is a logical predictor for the use of OLVR, because one can expect that as a household has increased money for technology the use of technology increases, and also because of the correlation between income and education, which is another logical predictor of technology use

than it did with Queen Anne's included (Figure 9); however, the variances are still quite wide in the EAC data.

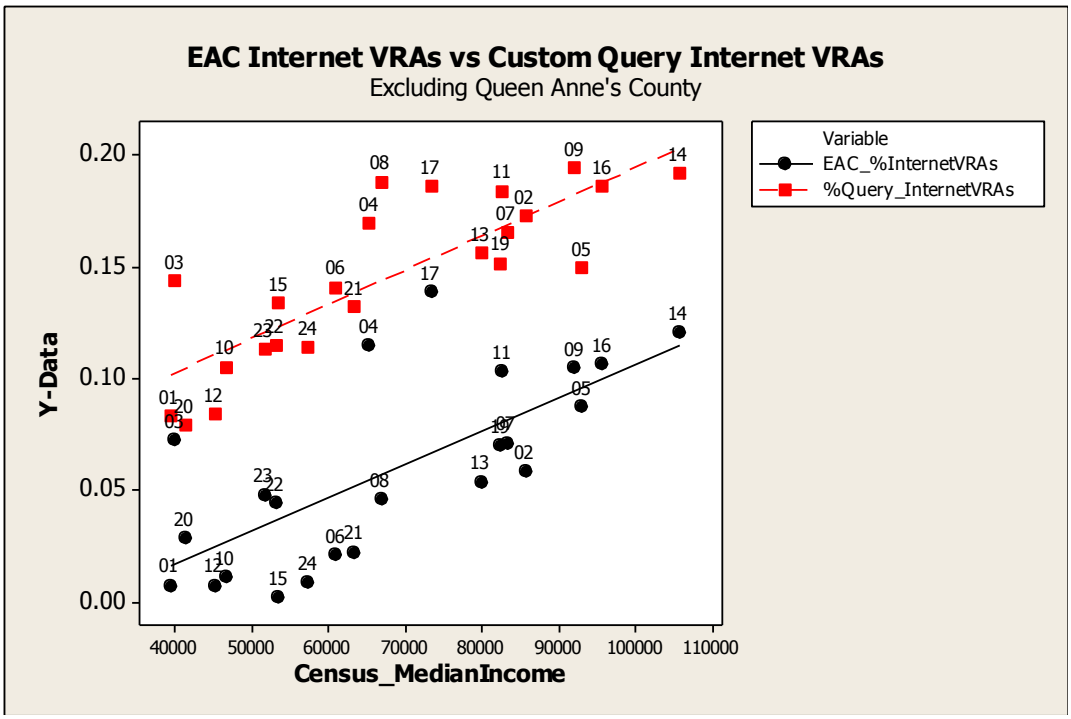


Figure 9 - Median Income and Internet Voter Registration Applications (excluding Queen Anne's County)

Some unusual observations were noted by MiniTab for both data sets: counties 4 and 17 appeared as unusual on the EAC report while counties 3 and 8 appear unusual on the custom query. However, a visual review of the residual histograms as well as the scatterplots show that while those counties show more variance it is not enough to consider them outliers in the sense that Queen Anne's County is. While some data imperfections are sure to exist, they do not appear to be dramatic enough to skew the overall correlation between the variables. The regression analysis shows that while the correlation for the EAC data is equally probable, it is slightly less reliable than the data from my query, because the EAC r-squared value is much lower than the r-squared value for my query results, indicating more variance in the data. I considered this test sufficient to support my use of the alternative data set whenever possible.

Predictor	Response	Adjusted R-squared	p-value
Census_MedianIncome	%Query_InternetVRAs	65.8%	<.001

Census_MedianIncome	%EAC_InternetVRAs	47.7%	<.001

Figure 10 -Regression Analysis for Internet VRAs with Median Income (Excluding county 18)

Since any tests using other states' data would be based on the EAC, I did a review of the Median Income with Internet Registrations for the Arizona and Kansas as well. Figure 11 shows that scatterplot, and while the other two states do not show as tight of a correlation as Maryland, a suggestion of a correlation is visible. Since the data was not precise enough to provide a tight correlation in Maryland, the similar variances in the other states was not surprising. However, it at least showed some similarity. Interestingly, this plot also shows that the longer a state has had OLVR, the more it will be used, which suggests future Maryland statistics will evolve.

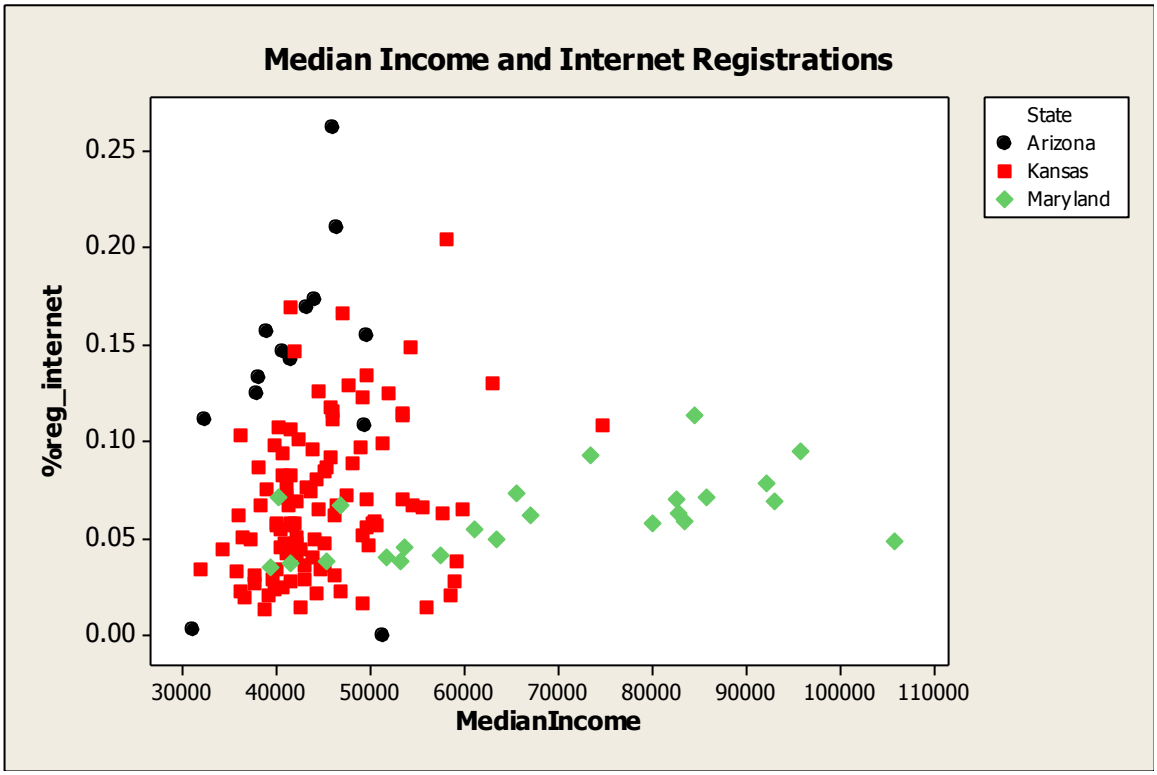


Figure 11 - Scatterplot: Other States Median Income and Internet Registrations[25]

[25] This graph, and all future graphs showing Internet Registrations from Arizona, excludes Maricopa County, Arizona. Maricopa is a significant outlier, with 72% of their registrations coming through the Internet. It is also the only county in Arizona with a median income higher than $50k ($55,099). Because the percentage of Internet registrations is so high and yet the Median income is not significantly higher, it skews the correlation.

CHAPTER 5

RESULTS AND DISCUSSION

Statewide Statistics

At a statewide level, the EMV application provided nearly half of all VRAs, at 44.43%. OLVR provided 17.25% of the VRAs and all the other sources combined provided 38%. The registrations received were a significant part of statewide turnout, with 18.58%[26] of total turnout coming from voters who had submitted an application during the sample time period. Of those voters who both submitted a VRA and turned out to vote, 19.02% had submitted an OLVR application, 42.38% had submitted an MVA application, and 38.6% had submitted some other form of application.

Females

While only 50.7% of the voters on the precinct register were female, 55.47% of all turnout was from females, with 75.78% of all registered females coming out to vote. 54.85% of the total VRAs were submitted from females and they made up 54.9% of those who both submitted a VRA and turned out to vote. 78.29% of the females who submitted a VRA in the sample also turned out to vote. Ata statewide level, females registered using the MVA at a higher rate but were more likely to vote after having registered using paper.

[26] The denominator of the turnout statistics in this section is the number of Active status voters on the precinct register.

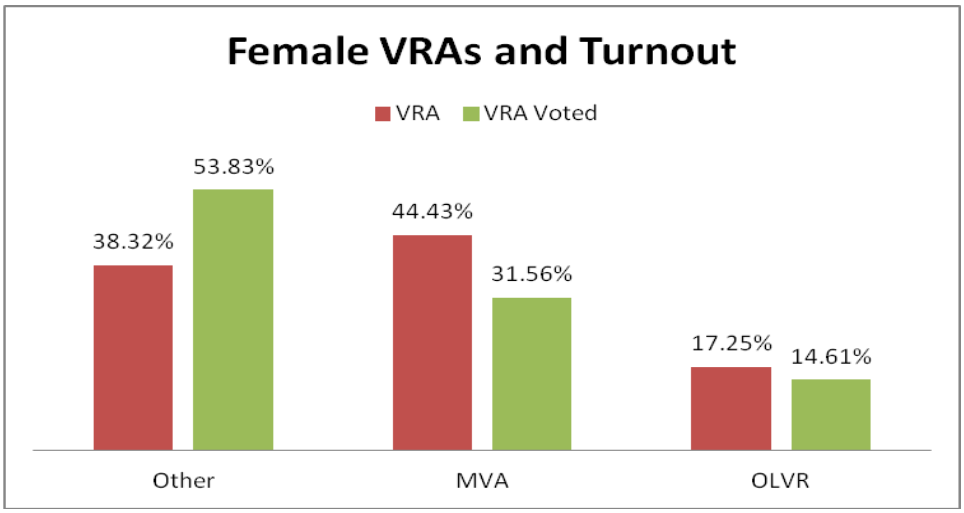


Figure 12 - Maryland VRAs and Turnout from Females[27]

Democrats

While only 52.17% of the precinct register consisted of Democrats, 56.92% of all turnout came from Democrats, with 75.56% of all Democrats turning out to vote. 57.99% of the VRAs came from Democrats and they made up 57.46% of all who both submitted a VRA and turned out to vote. 79.79% of the Democrats who submitted a VRA also turned out to vote. Democrats were slightly more likely to register to vote at the MVA but had a higher percentage of turnout versus registrations only in the OLVR category.

[27] While looking at this data from a statewide level is interesting and informative, it cannot be evaluated for statistical significance. Therefore, after the initial evaluation at a statewide level, this paper also reports on data at a jurisdiction and individual level, depending on the topic. Those levels of analysis allow for a determination of statistical significance.

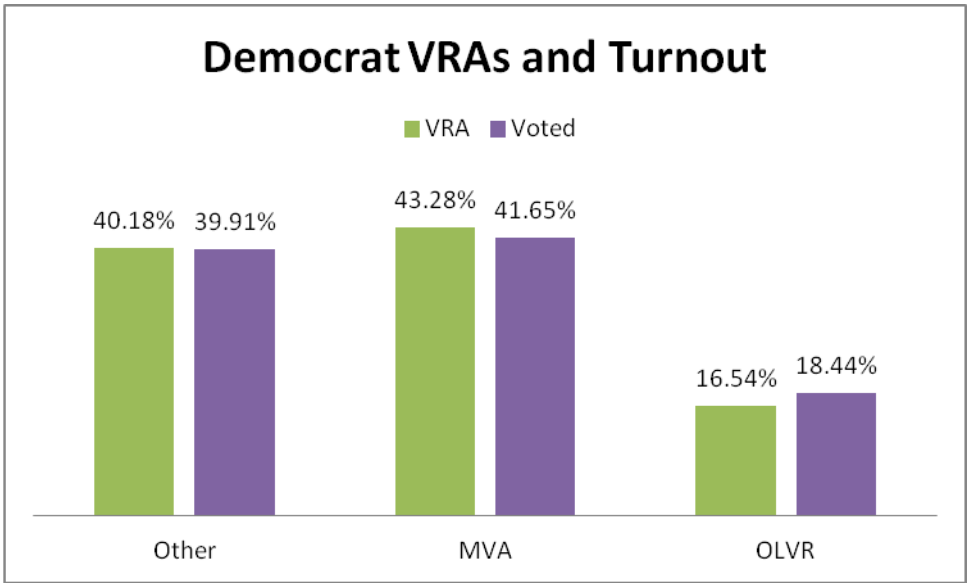


Figure 13 - Democrat VRAs and Turnout

Republicans

24.31% of voters on the precinct register were from Republicans and 27.3% of all turnout was from Republicans, with 77.76% of the Republicans on the precinct register voting. Only 19.36% of total VRAs came from Republicans and 18.91% of those who both submitted a VRA and turned out to vote were from Republicans. 78.83% of the Republicans who submitted a VRA also turned out to vote. Republicans were more likely to register at the MVA than anywhere else, but showed a reduction in turnout among MVA registrations turnout from OLVR and other sources was higher than the registration percentage.

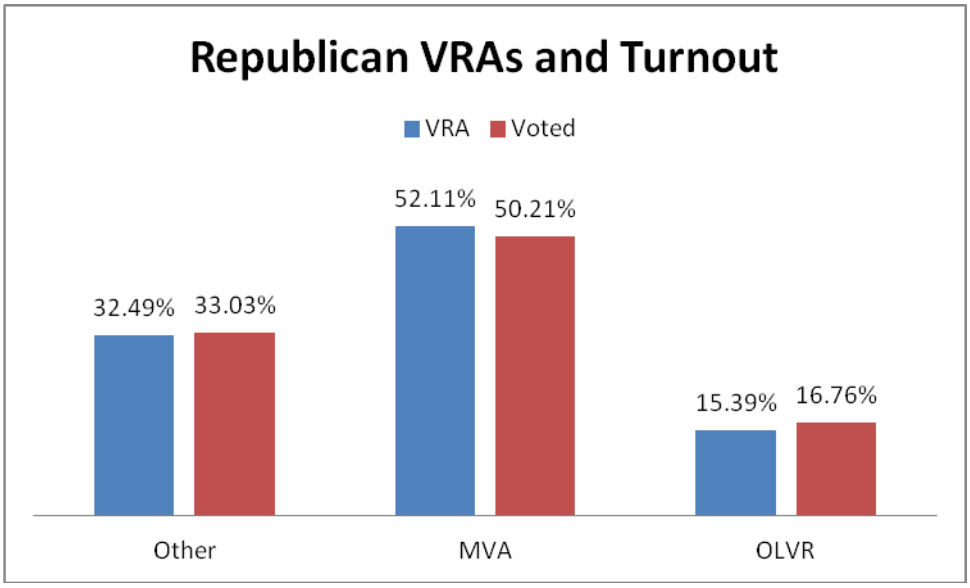


Figure 14 - Republican VRAs and Turnout

Unaffiliated

Only 15.58% of the voters on the precinct register were from unaffiliated voters, and they made up 14.46% of all turnout, with only 64.28% of all unaffiliated voters turning out to vote. 20.72% of the VRAs in the sample came from unaffiliated voters and 18.57% of those who both turned out a VRA and voted were unaffiliated. 72.17% of the unaffiliated voters who submitted a VRA turned out to vote. Unaffiliated voters were more likely to register at the MVA than any other method, but to a lesser degree than the other parties, and a higher percentage of unaffiliated voters chose to use OLVR when compared to Democrats or Republicans. Unaffiliated voters who registered using either paper or OLVR were more likely to vote than those who registered at the MVA.

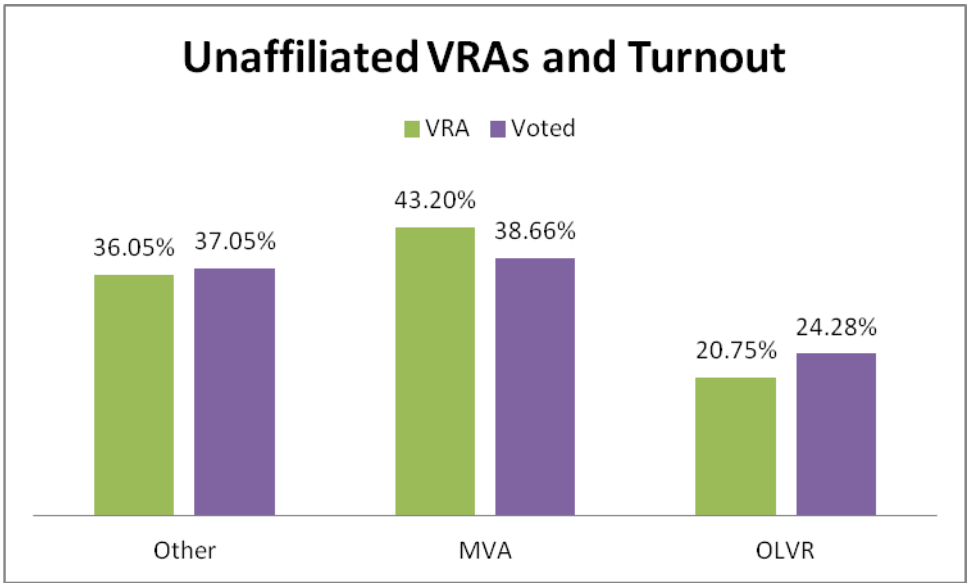


Figure 15 - Unaffiliated VRAs and Turnout

Third Party

Third party voters are a very tiny portion of the Maryland voter population, with 1.53% of the voters on the precinct register being third party voters and 1.32% of all turnout coming from third party voters. Just 59.93% of all third party voters turned out to vote in the 2012 General election. 1.96% of the VRAs in the sample came from third party voters and 2% of all who submitted a VRA and voted came from third parties. 82.09% of those who submitted a VRA also voted. Third parties were three times more likely to register using paper than any other method, and they were less likely to vote if they had registered at the MVA.

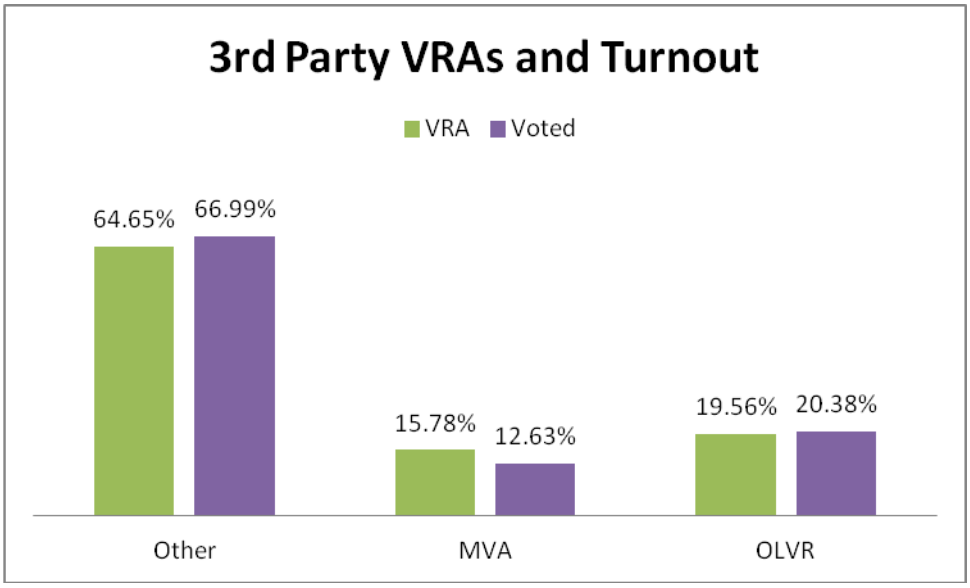
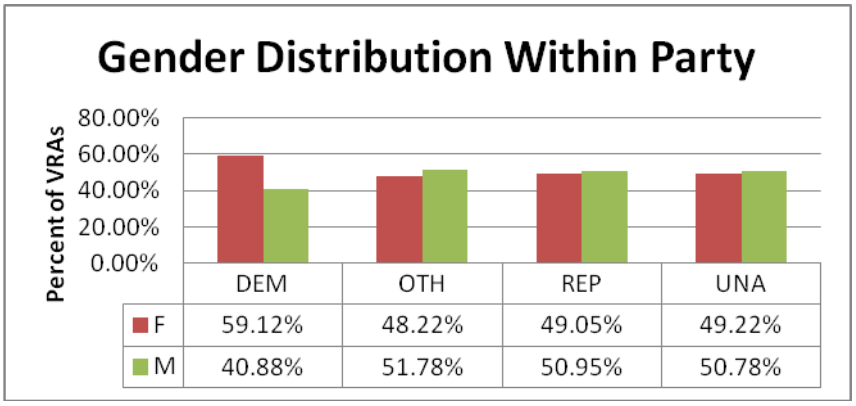


Figure 16 - Third Party VRAs and Turnout

Gender Distribution By Party.

Democrats at a statewide level are 59.12% female, while all other parties have more males than females. This is related to the fact that 63.15% of the women in Maryland live in four counties: Baltimore City, Baltimore County, Montgomery County, and Prince George's county, which are all highly Democratic counties. For this reason, a county-level review of party and gender is necessary to make any final conclusions regarding actual registration preferences.



	DEM	OTH	REP	UNA
F	59.12%	48.22%	49.05%	49.22%
M	40.88%	51.78%	50.95%	50.78%

Figure 17 - Gender Distribution Within Party

18-29 Year olds

19.32% of the active voters on the precinct register were in the 18-29 year old age bracket as of election day and they made up 16.33% of the total turnout, with 58.53% of all

18-29 year olds on the precinct register turning out to vote. 34.57% of all the VRAs in the sample came from this group and 31.85% of those who submitted a VRA and voted were between 18-29 years old. 74.19% of all 18-29 year olds who turned in VRAs turned out to vote. They were most likely to register using paper applications, but more likely to turnout out to vote if they had registered using OLVR.

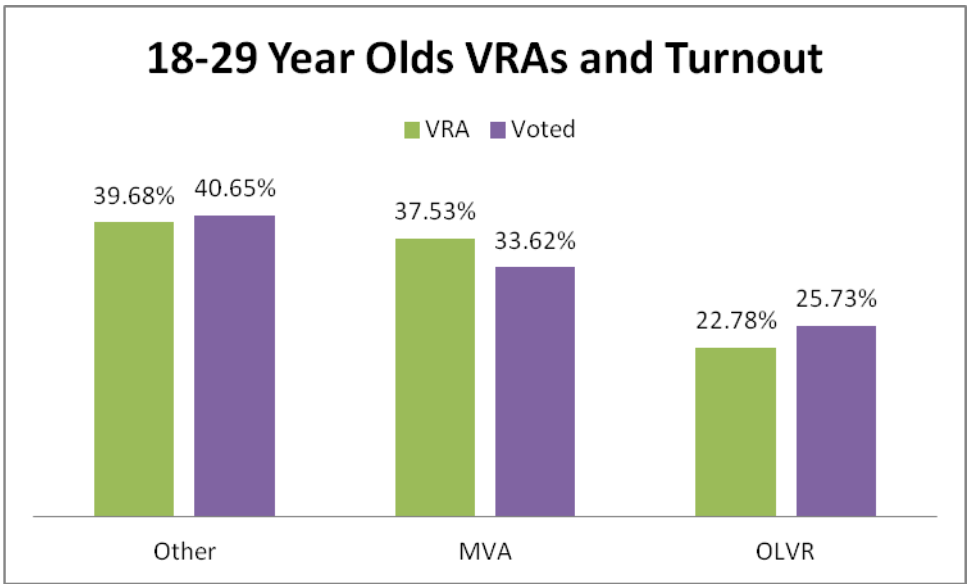


Figure 18 - 18-29 Year Olds VRAs and Turnout

30-49 Year Olds

The 30-49 year old age bracket made up 35.56% of all active registered voters on the precinct register. This age group made up 34.09% of the final turnout, with 66.58% of that 30-49 year olds turning out to vote. 34.05% of the sample VRAs came from this age group, 34.87% of all those who submitted VRAs and voted were from this age group, and 82.49% of all 30-49 year olds who submitted a VRA turned out to vote. This age group was most likely to register at the MVA, and most likely to turn out to vote if they had registered using OLVR.

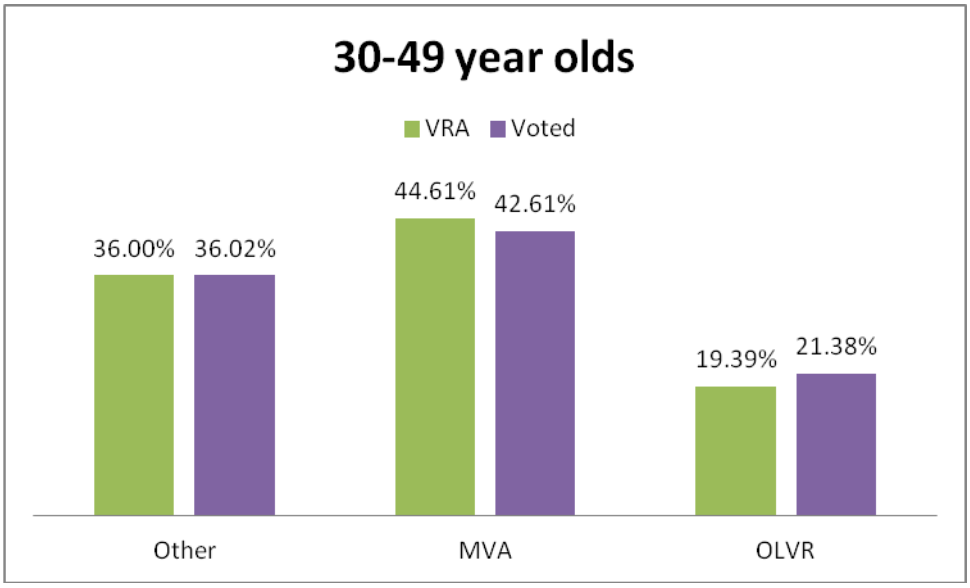


Figure 19 - 30-49 Year Olds VRAs and Turnout

50-64 Year olds

27.08% of the voters on the precinct register were in the 50-64 year old age bracket and they made up 30.42% of the final turnout. 77.80% of all 50-64 year olds turned out to vote. 18.68% of the VRAs in the sample were from this age group, 19.68% of those who submitted a VRA and voted were from this age group, and 84.87% of all 50-64 year olds who submitted a VRA also turned out to vote. This age group was most likely to register at the MVA and was marginally more likely vote after registering with OLVR.

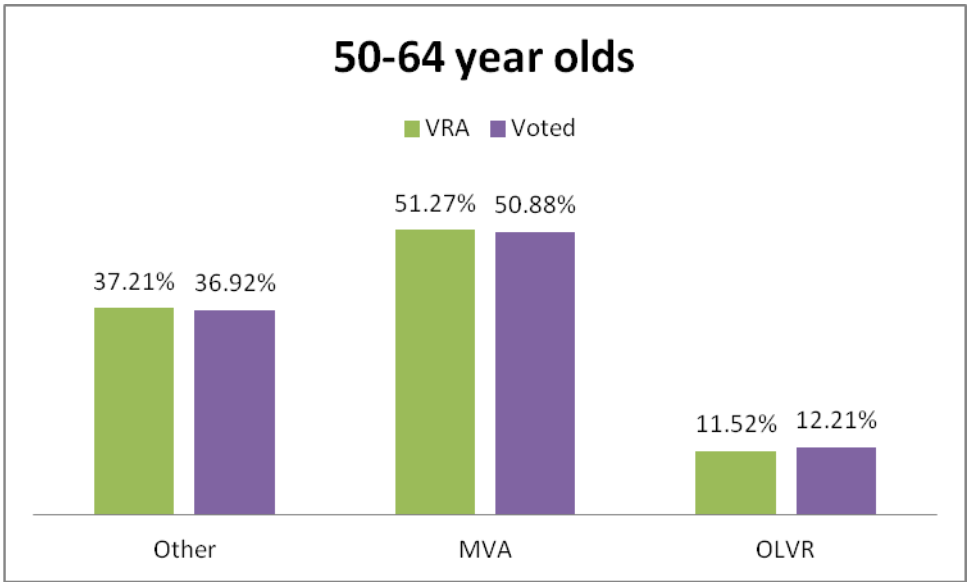


Figure 20 - 50-64 year olds VRAs and Turnout

65 and up

18.14% of the active voters on the precinct register with 65 and older and they made up 17.34% of the total turnout. 66.21% of the 65 and older age group turned out to vote. 9.97% of all VRAs in the sample came from those 65 and older, 10.50% of those who submitted VRAs and turned out to vote were from this age group, and 84.82% of the 65 and older group who submitted a VRA also turned out to vote. This age group was more likely to register at the MVA and show no difference in the likelihood of turning out vote based on registration source.

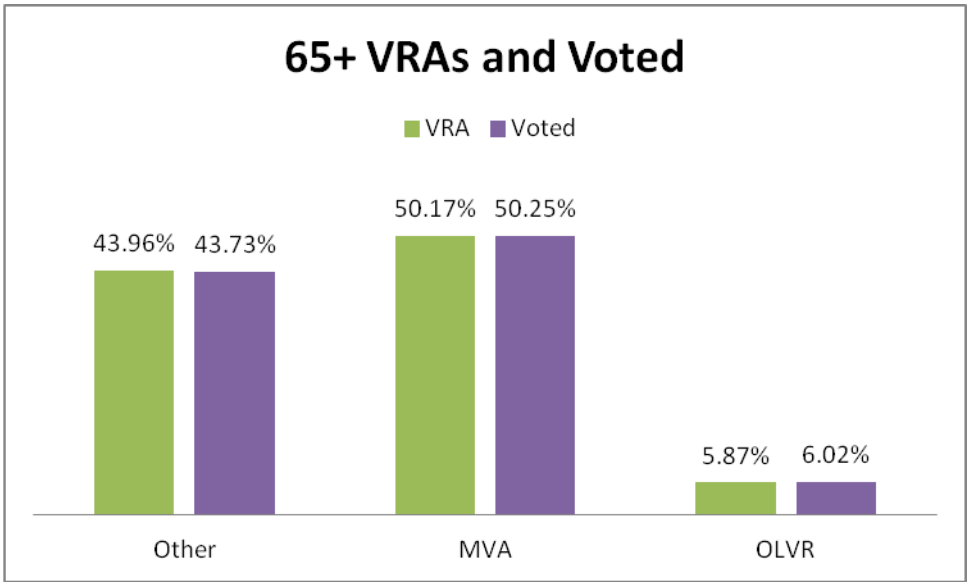


Figure 21 - 65 and over VRAs and Turnout

All Ages and Registration Source

The prior charts show the percentage of VRAs within each demographic that came from each registration source. However, because most VRAs statewide came from the MVA and the smallest number came from OLVR, it is useful to see what percentage of the registrations within a given source came from a particular demographic. The scatter plots in the following sections take that approach.

Figure 22 shows what percentage of VRAs came from which source by each age as of the November 2012 election: it shows that the use of OLVR decreases steadily as age increases while the use of other applications increases. The highest percentages of MVA VRAs were not in the 16 to 20 age when people first get their driver's licenses, but were

actually in the middle decades, around 45 to 75. MVA applications drop off sharply as people reach ages when they stop driving.

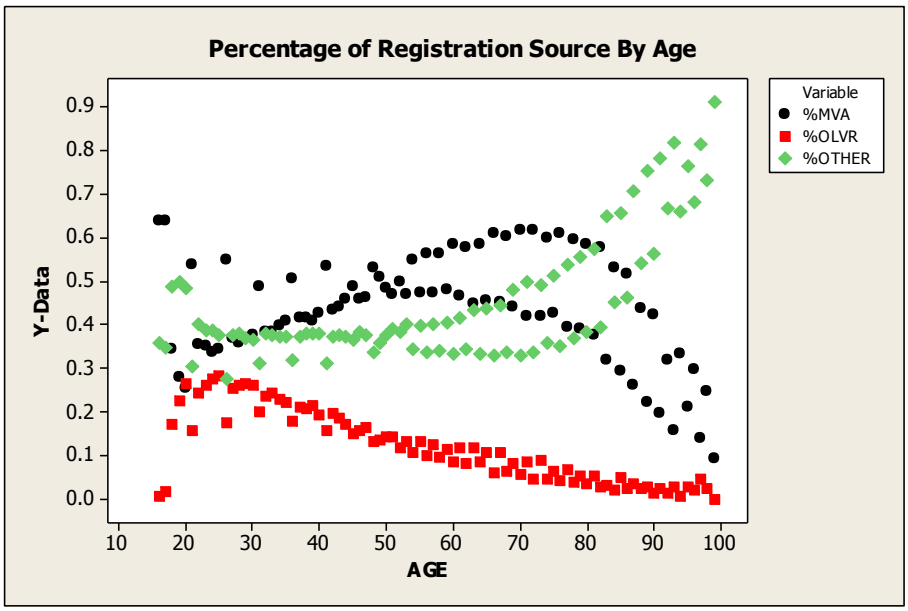


Figure 22 - Scatterplot: Percentage of Registration Source Within Age

Figure 23 shows counts statewide of VRAs from Females by both Source of Registration and Age. The plot suggests that females of any age show a preference for paper registrations but only marginally and the difference may only be significant after age 60. However, with this being a statewide plot, it does not take into account the fact that the four most heavily populated counties are also primarily Democratic and have the largest percentage of the females in the state. If female Democrats in those counties were more likely to register using forms other than MVA or OLVR, it would skew the statewide totals. Therefore, a county analysis is required.

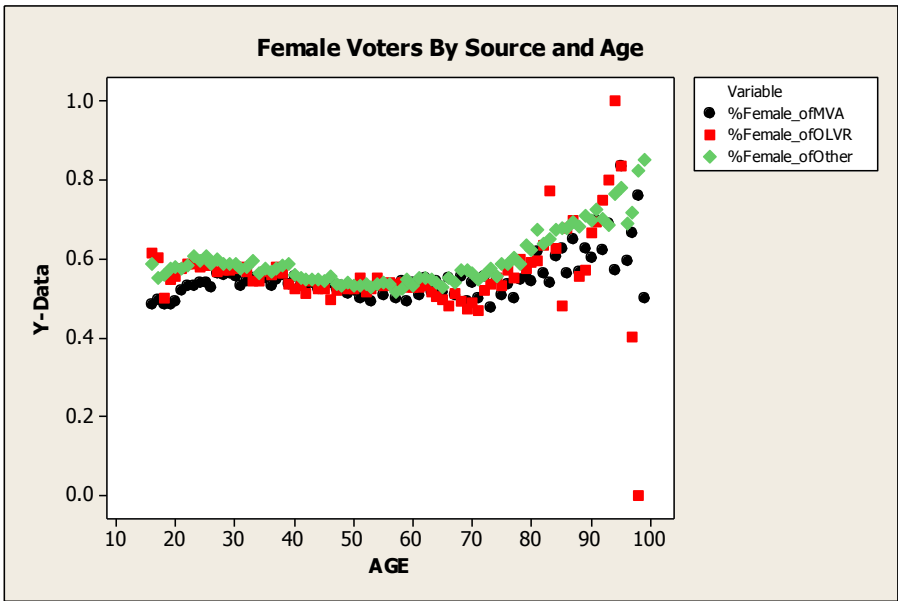


Figure 23 - Scatterplot of Female Voters by Source and Age

Figure 24 shows the same totals by party, and the plot by Democrats suggests again that the four largest counties skew the statewide results, because the Democrat chart does show a slight preference for paper applications for most ages, which is not incongruous with the data in Figure 13 - Democrat VRAs and TurnoutFigure 13 showing a percentage of "Other" VRAs nearly as high as the percentage of MVA ones. The Republicans of all ages are most likely to use MVA until the very late ages, when, like with Democrats, a few ages show more OLVR records. The unaffiliated chart matches the data in Figure 15: unaffiliated voters of all ages are more likely to use OLVR over other registration methods, sometimes as much as 10% more. Finally, the third party chart also correlates with the finding that third-party voters are more likely to use OLVR.

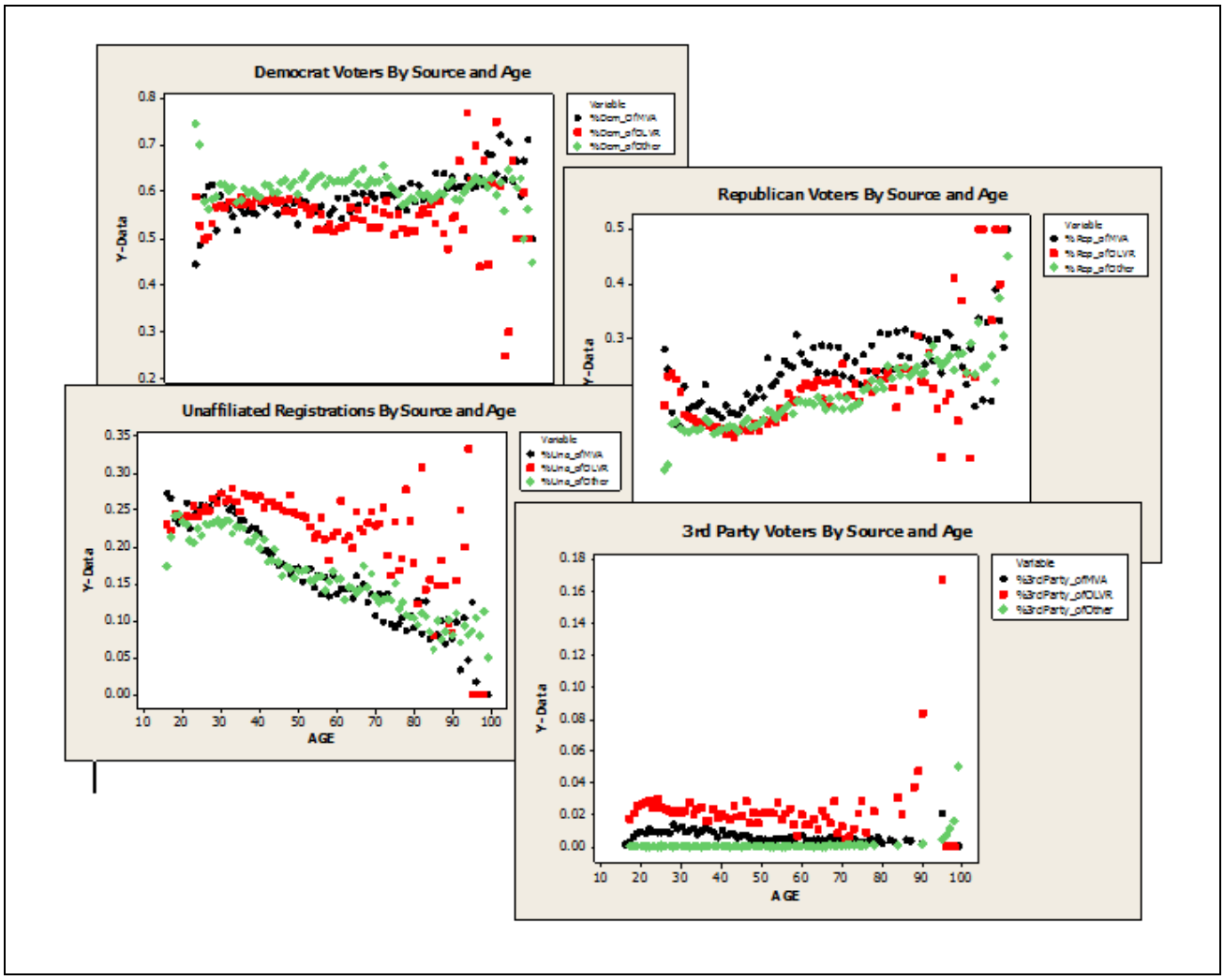


Figure 24 - Scatterplots Showing Party by Source and Age

Figure 25 takes all the demographics and puts them together. The democrat female plot shows the same pattern as the general female plot, with a very slight preference for registering on paper. It is significant because of its consistency, although it appears to be less than 1% difference throughout the graph. When comparing this to the Democrat graph in Figure 24 it becomes clear that it is the men who alter the pattern for the Democrat voters, increasing the "Other" applications among the younger ages and increasing the MVA and OLVR applications for those over 80 years of age.

Comparing the two Republican graphs, the same pattern is obvious, but the preference for MVA registrations is not as strong. The two unaffiliated plots also show the same pattern, but the preference for OLVR is much smaller – by approximately 5%. Finally, the third party

graph completely changes, going from an order of preference of OLVR, then MVA, and then Other, to Other, then OLVR and last MVA. This indicates that the Democrat pattern of preferring paper VRAs is not what drives the Female plot, but in fact it is the Female pattern driving the Democrat plot. It also indicates that the third party and unaffiliated preferences for OLVR are significant enough that they overcome the female tendency to use other methods first. However, these findings continue to point to the need to view counties independent of population size, because at the statewide level the four highly populated and Democrat counties (Montgomery, Prince George's, Baltimore City and Baltimore County) overpower any trends that might be different in the smaller counties.

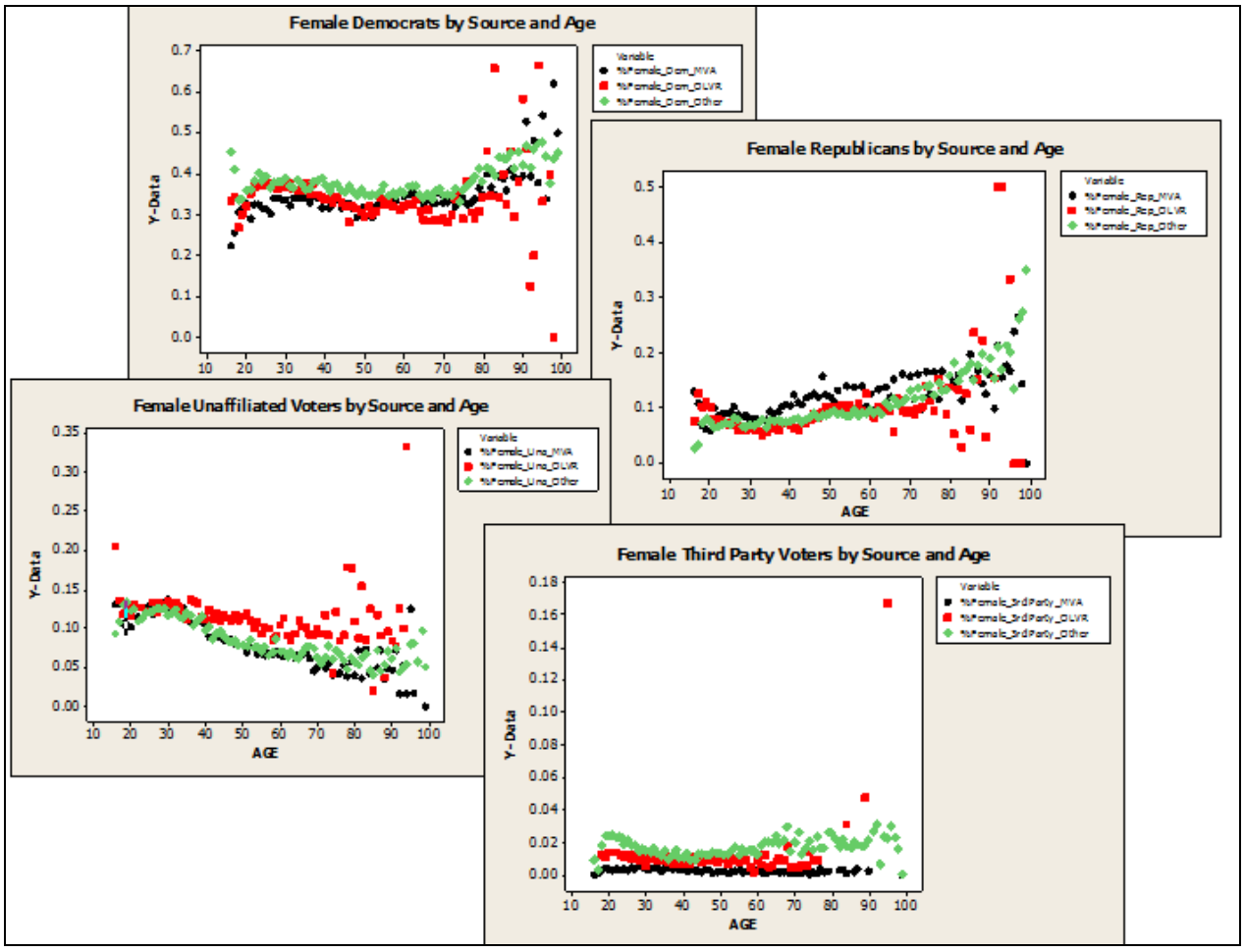


Figure 25 - Scatterplots of Female Voters by Party and Registration Source and Age

Maryland Counties and Other States

The following section looks at the registration statistics by county instead of only at the statewide level in order to remove the bias provided by the largest counties. It also includes a section on Gender in other states.

Gender and Registration Source

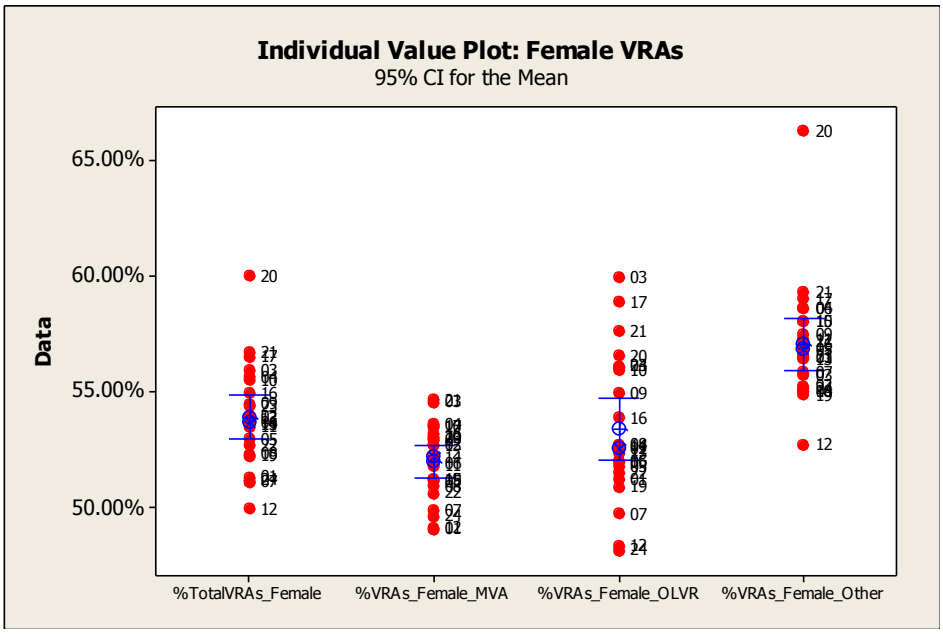


Figure 26 – Maryland VRA Sources and Females

The first group in Figure 26 displays the individual values representing what percent of all VRAs received in each county were received from females and what percent of all VRAs from each registration source came from females.[28] A visual inspection suggests that females may prefer paper to any other method of registration and may be less likely to use the MVA system, which is consistent with the statewide plot in Figure 23 .

Table 1 - Gender Source of Registration Tests

Variable 1	Variable 2	Test Used	Alternate Hypothesis	p-value	Confidence Interval
%VRAs_Female_Other	%VRAs_Female_MVA	Mann–Whitney	$\mu > 0$	<.0001	0.03696,0.05860

[28] The graph shows that Somerset County (county 20) is unusual in the high percentage of female registrants, particularly through the paper system; however, with over 22% of its female applications being for 18-21 year olds, it is possible those represent college students at the University of Maryland Eastern Shore.

%VRAs_Female_Other	%VRAs_Female_OLVR	Mann–Whitney	$\mu > 0$	.0001	0.02266,0.05258
%VRAs_Female_MVA	%VRAs_Female_OLVR	Mann–Whitney	$\mu \neq 0$	.1875	-0.02881,0.00475

Running the tests in Table 1 confirmed the visual inspection: the median percentage of paper applications from females is anywhere from 3.7% to 5.9% higher than the median percentage of applications from females via the MVA and is anywhere from 2.3% to 5.3% higher than the median percentage of applications from females via OLVR. The difference between MVA and OLVR is too widely varied to make a determination of preference. The reverse of the statistics is obviously true for males[29], meaning that males are more likely to use either the MVA or OLVR than paper applications, but the difference between MVA and OLVR is too varied to make a conclusion.

To determine if either females or males are more likely to use OLVR, I calculated for each county the difference between the percent of VRAs from females and the percent of VRAs from males and tested it using the Mann-Whitney test against the difference between the percent of OLVR VRAs from females and the percent of OLVR VRAs from males. The differences show as insignificant, with some counties showing a preference by males and some showing a preference by females.

Figure 27 shows a similar plot showing the county values for the percentage of turnout from those who submitted VRAs of a given source who were. Mann-Whitney's confirm the significance of the plot: among females who vote, paper applications are used by a range of 2.5% to 5.2% more frequently than MVA applications and are used by a range of 2% to 5% more frequently than OLVR applications.

[29] A small percentage of applicants do not provide gender, but the number is insignificant and for purpose of this analysis those VRAs are counted as male.

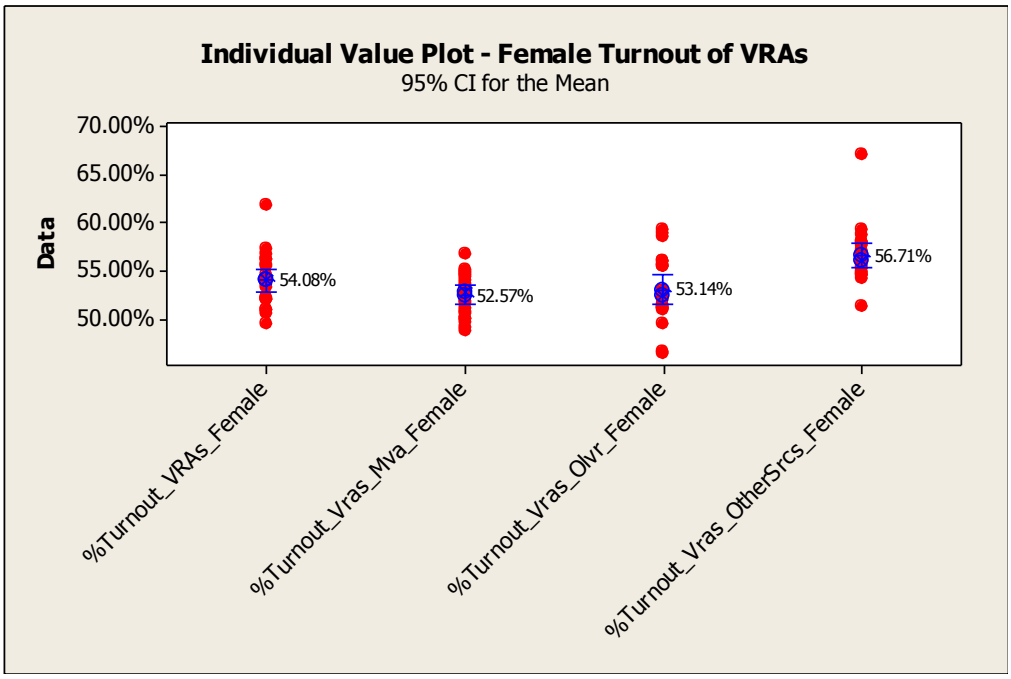


Figure 27 - Individual Value Plot - Female Turnout of VRAs

Gender significance in other states

Because the only data available from other states was Census data and EAC data, detailed analysis such as the one above was not possible when compared Maryland to other states. Furthermore, because I could not control the type of "other" applications with the same detail as in the Maryland data, I could only look at the MVA and Internet registration sources.

Figure 28 shows the percentage of registrations which came from the MVA correlated with the percentage of females in the population according to the 2010 Census data for the five states in the sample with MVA applications. Figure 29 shows the same plot using the percent of Internet VRAs for all counties which had a value for Internet VRAs except Maricopa County, Arizona, which had over 69% of all registrations come through OLVR and thus skews any display. In neither case is there a correlation between gender and source of registration, which fits the finding in Maryland that the females showed a preference of Other VRAs but that no statistical difference was apparent between the percentage of females and males using OLVR.

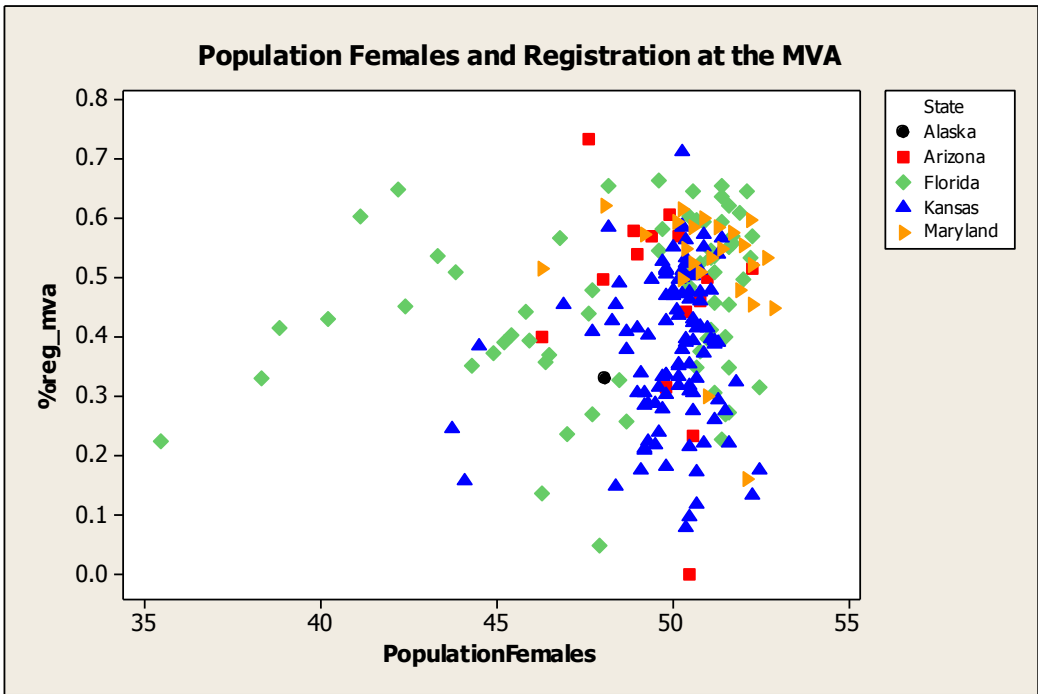


Figure 28 - MVA Registrations and the Percent of Female Population

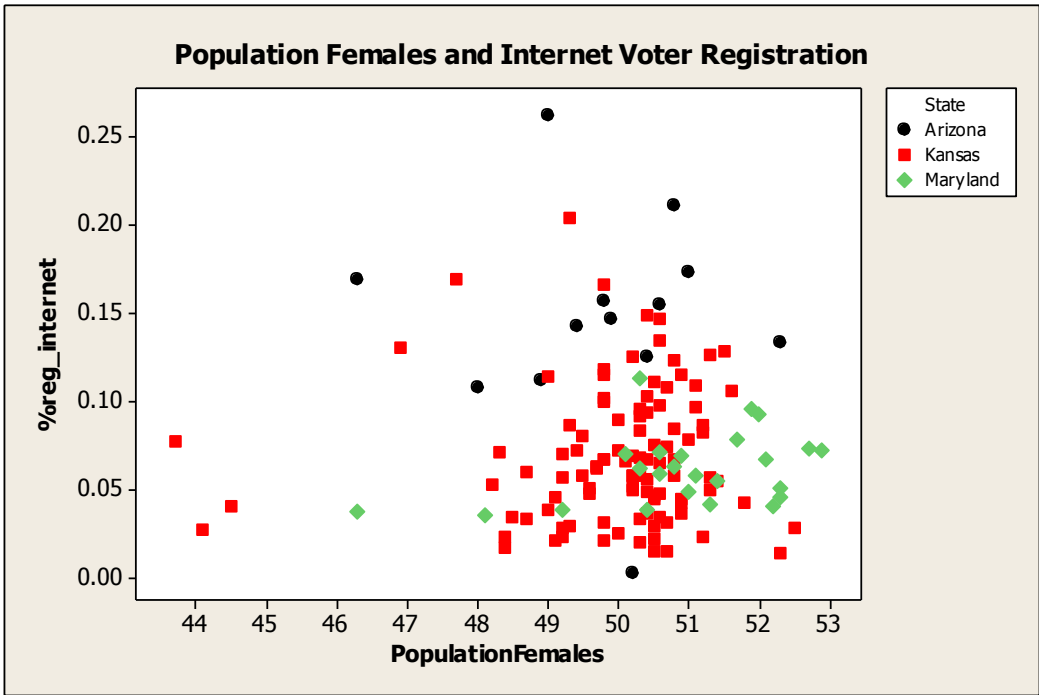


Figure 29 - Population Females and Internet Voter Registration

Party and Registration Source

Democrats

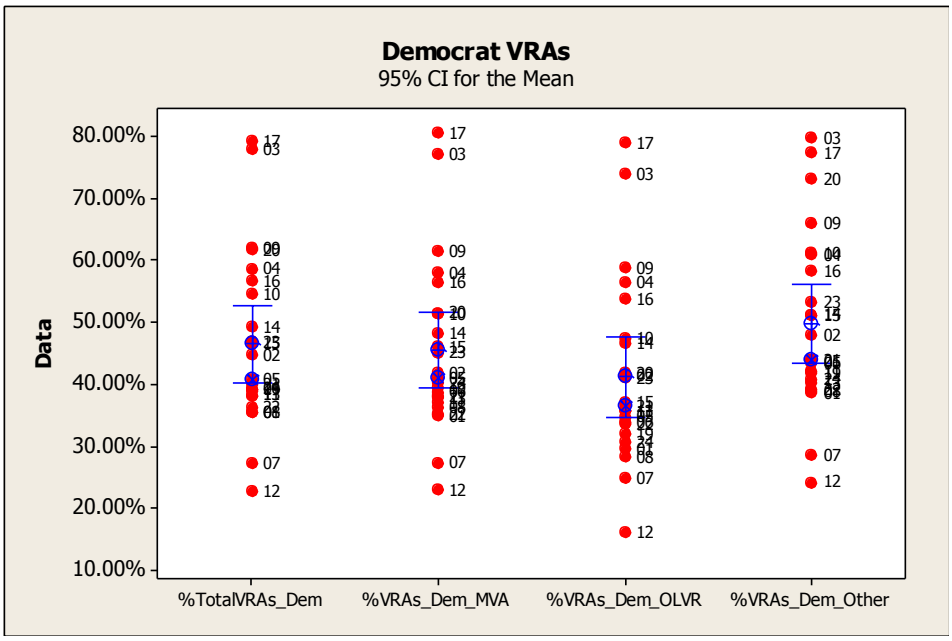


Figure 30 - Individual Value Plot: Democrat VRAs

The first group in Figure 30 displays the individual values representing what percent of VRAs received in each county were received from democrats. The following three groups represent what percent of VRAs from each of the noted registration sources came from Democrats. The graph shows that counties 17 (Prince George's) and 3 (Baltimore City) have an unusually high percentage of Democrat registrants; however, that is to be expected, because over 78% of the active registrants on the precinct register in each of those jurisdictions were Democrat. A visual inspection suggests that the data is too highly varied for any strong statement to be made. If one can be suggested, it is that Democrats are less likely to use OLVR than other systems.

Table 2 - Democrat Source of Registration Tests

Variable 1	Variable 2	Test Used	Alternate Hypothesis	p-value	Confidence Interval
%VRAs_Dem_Other	%VRAs_Dem_MVA	Mann–Whitney	$\mu \neq 0$	.1802	-0.0250,0.1247
%VRAs_Dem_Other	%VRAs_Dem_OLVR	Mann-Whitney	$\mu \neq 0$	.0211	0.0195,0.1670

%VRAs_Dem_MVA	%VRAs_Dem_OLVR	Two-Sample T Test	$\mu \neq 0$	.324	-0.0434, 0.1284

Running the tests in Table 2 confirmed the visual inspection: little statistical evidence exists for Democrats using one form of voter registration over another. The comparison of OLVR registrations to Other registrations is the only one that shows any statistical significance, but since the confidence interval shows that the median difference can range anywhere from 1.9% to 16.7%, the statistic can only be used to state that Democrats probably are represented in OLVR registrations to a lesser degree than in paper ones, but not strongly.

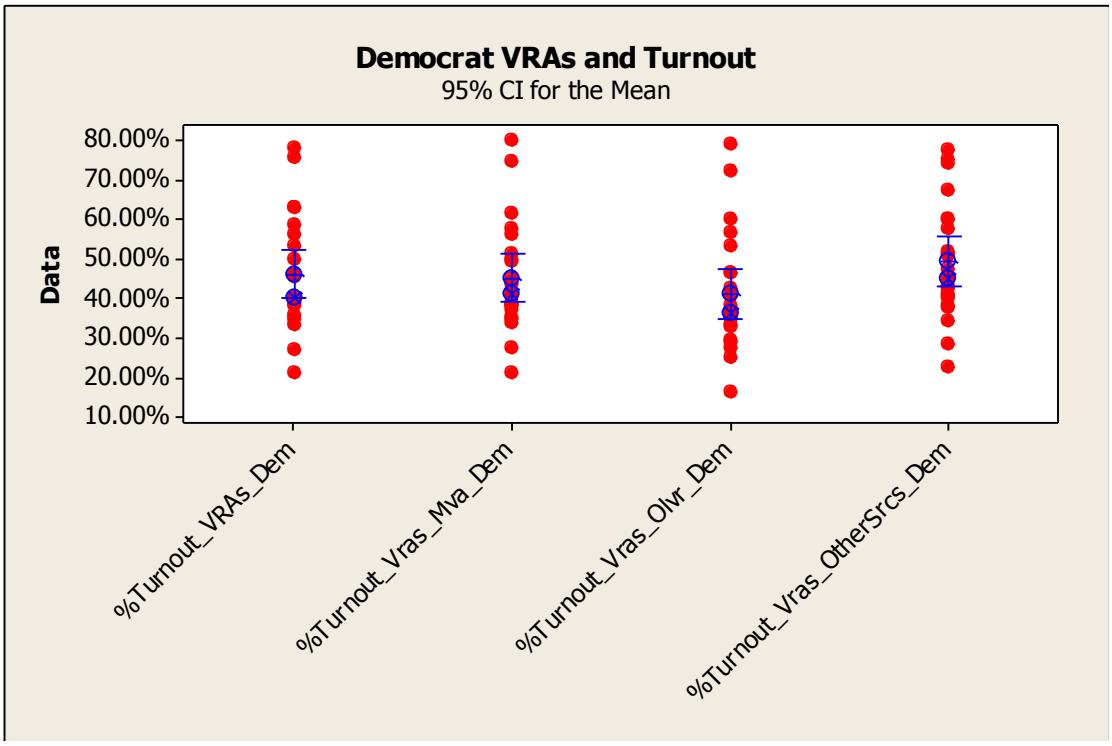


Figure 31 - Individual Value Plot: Democrat VRA Turnout

Figure 31 displays Democrats as a percentage of those who both submitted a VRA and voted. Like with the Female plot, the "other" category is several percentage points higher than the OLVR one. A Mann-Whitney test confirms that among the Democrats who submitted a registration and voter, the use of "other" sources of registration were between 1 and 16% higher than the use of OLVR, small but consistent preference.

Republicans

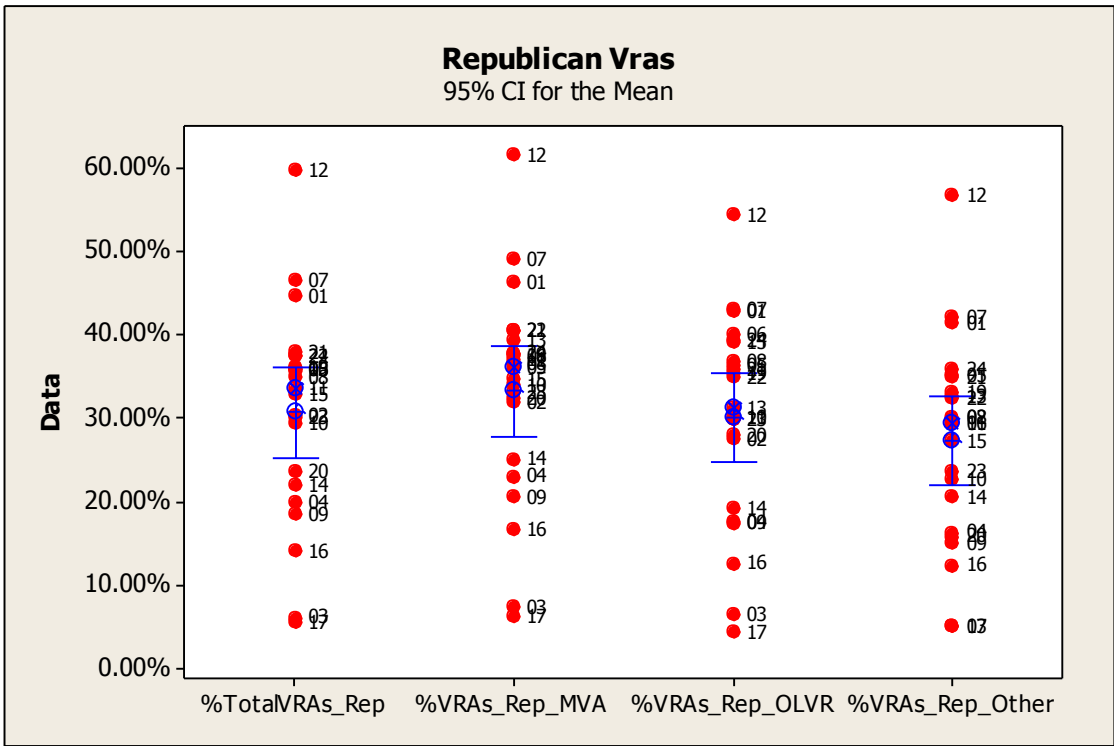


Figure 32 - Individual Value Plot: Republican VRAs

The first group in Figure 32 displays the individual values representing what percent of VRAs received in each county were received from Republicans. The following three groups represent what percent of VRAs from each of the noted registration sources came from Republicans. The graph shows that county 12 (Garrett County) has an unusually high percentage of Republican registrants; however, that is to be expected, because over 60% of the active registrants on the precinct register in that jurisdiction were Republican. A visual inspection suggests that, like with the Democrat data, the values are too highly varied for any strong statement to be made when reviewing the counties as whole. If one can be suggested, it is that Republicans are less likely to use paper registrations than other registration methods.

Running the tests in Table 3 confirmed the variances in the data: the only significant finding is that Republicans are slightly more likely to use the MVA than Other registration methods.

Table 3 - Republican Source of Registration Tests

Variable 1	Variable 2	Test Used	Alternate Hypothesis	p-value	Confidence Interval

%VRAs_Rep_Other	%VRAs_Rep_MVA	Mann–Whitney	$\mu \neq 0$	.0369	-0.1326,-0.0048
%VRAs_Rep_Other	%VRAs_Rep_OLVR	Mann-Whitney	$\mu \neq 0$	.2533	-0.1005,0.0304
%VRAs_Rep_MVA	%VRAs_Rep_OLVR	Mann-Whitney	$\mu \neq 0$	.3337	-0.0314,0.0930

Figure 33 shows the Republican turnout among those who had submitted VRAs. While the variances are smaller, the only significant finding is a very slight preference for MVA applications. Like the Democrat data, the data points are too varied to indicate any strong preference for one type of registration over any other, but among registrants who also voted, MVA is more likely to have been used than paper sources while OLVR shows no significant differences.

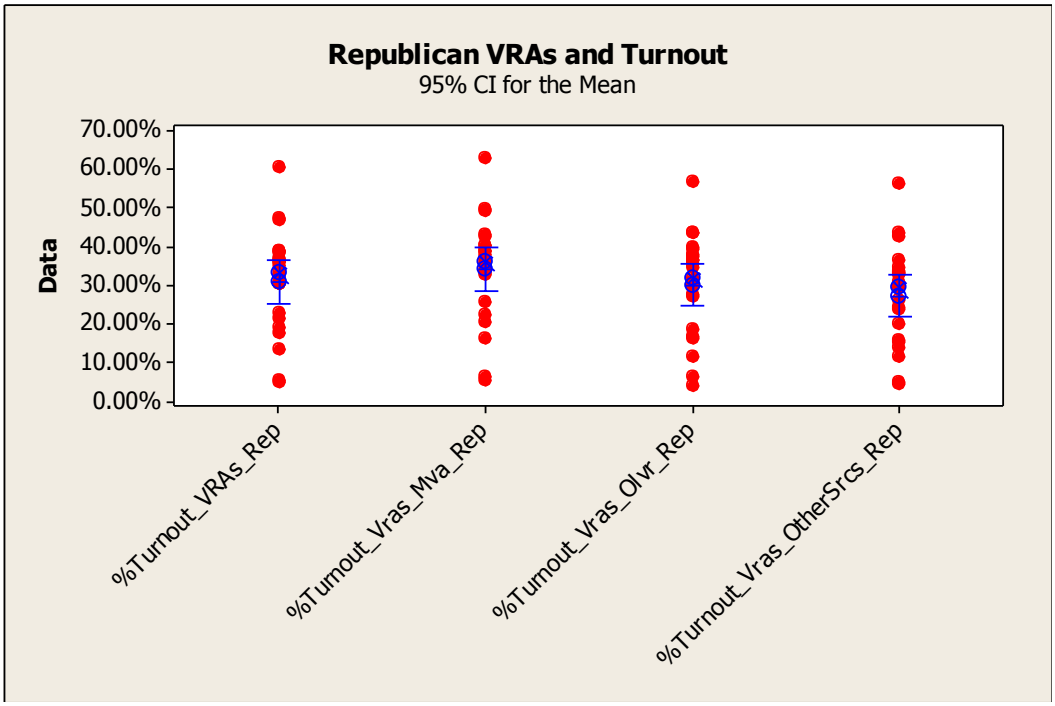


Figure 33 - Individual Value Plot: Republican VRAs and Turnout

Unaffiliated

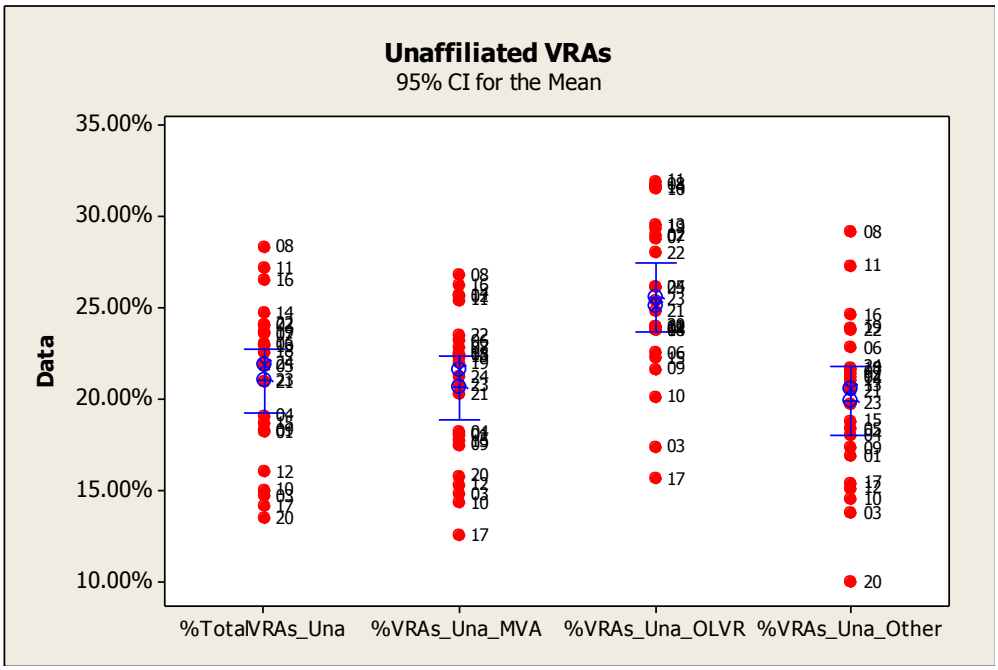


Figure 34 - Individual Value Plot: Unaffiliated VRAs

The first group in Figure 34 displays the individual values representing what percent of VRAs received in each county were received from unaffiliated voters. The following three groups represent what percent of VRAs from each of the noted registration sources came from unaffiliated voters. This plot is still slightly scattered, but actually appears to have a tighter distribution than either Democrats or Republicans. A review of the spread of Unaffiliated voters throughout the state using a variety of Census data (including racial demographics, education level, median income, percentage over 65) showed that only county median income and the percent in poverty have a correlation with the percentage of Unaffiliated voters in a county, and that relationship is too loose to be used for purposes of grouping the counties for a more precise analysis. So the analysis was done at a statewide level.

A visual inspection suggests that some distinct differences may be visible. Specifically, the plot suggests that unaffiliated voters may prefer OLVR registration over any other method. However, little difference is obvious between the Other methods and the MVA method.

Table 4 Unaffiliated Source of Registration Tests

Variable 1	Variable 2	Test Used	Alternate Hypothesis	p-value	Confidence Interval
%VRAs_Una_MVA	%VRAs_Una_OLVR	Mann–Whitney	$\mu < 0$	.0005	-0.08075,-0.02357
%VRAs_Una_Other	%VRAs_Una_MVA	Mann–Whitney	$\mu < 0$	.2765	-0.03592,0.0202
%VRAs_Una_Other	%VRAs_Una_OLVR	Mann–Whitney	$\mu < 0$	<.0001	-0.08315,-0.0282

Running the tests in Table 4 confirmed the visual inspection: the percentage of unaffiliated voters among OLVR VRAs is anywhere from 2.4% to 8.1% higher than the percentage among MVA registrations and is between 2.8% and 8.3% higher than among paper registrations. However, unaffiliated voters show no statistical preference between MVA and Other voter registration methods.

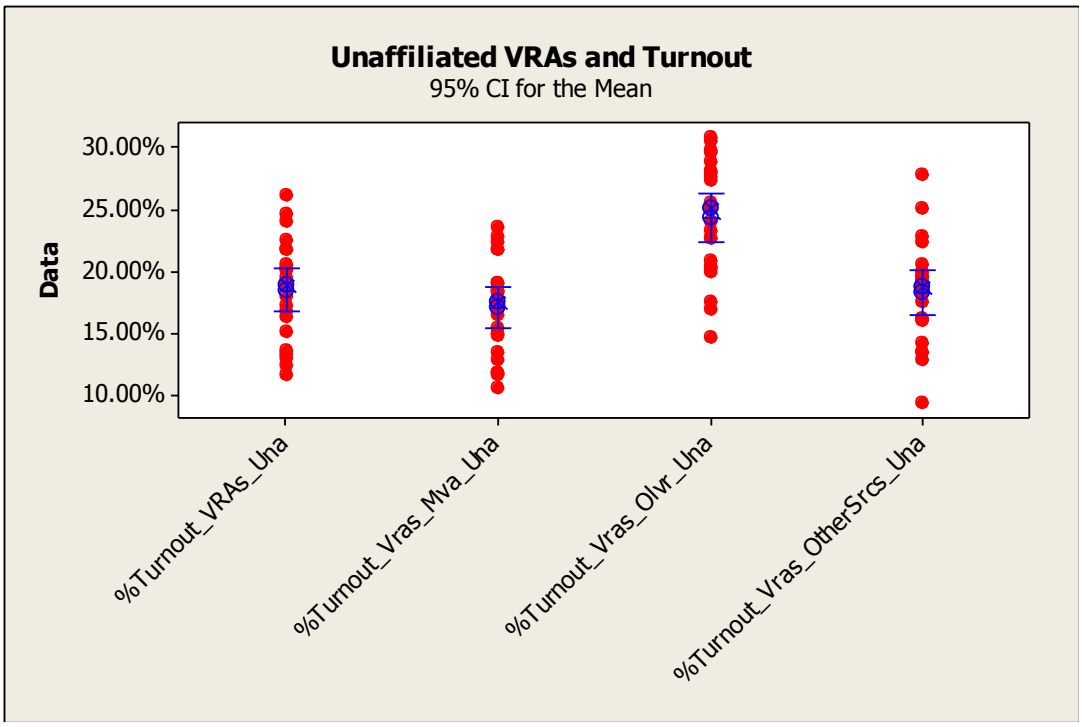


Figure 35 – Individual Value Plot: Unaffiliated VRAs and Turnout

Figure 35 shows the same plot but only for those who turned out to vote. As with Democrats and Republicans, the plot of those who voted shows tighter values. A Mann-Whitney test confirms a very strong preference among those unaffiliated voters who turn out

to vote: they are between 3.5 and 9.2% more likely to use OLVR than paper applications and between 4.9% and 10.3% more likely to use OLVR than the MVA. This is an even stronger preference than among all those who submitted a VRA. The difference between OLVR and MVA is insignificant.

Third Parties

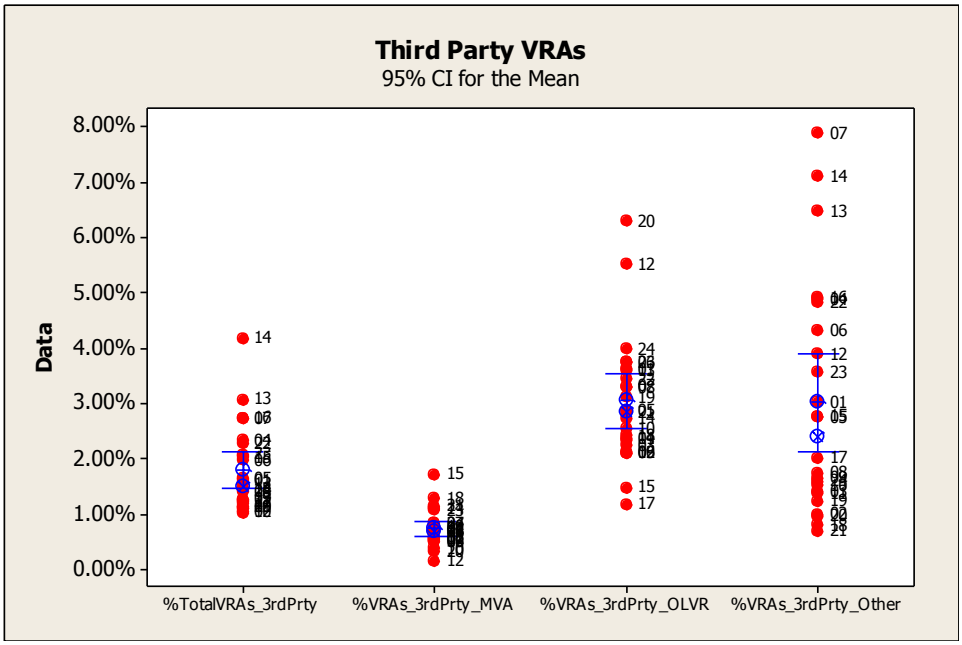


Figure 36 - Individual Value Plot: 3rd Party VRAs

The first group in Figure 36 displays the individual values representing what percent of VRAs received in each county were received from third party voters[30]. The following three groups represent what percent of VRAs from each of the noted registration sources came from third party voters. Other than a few outliers, this plot shows values with much smaller ranges than any other political party. Since counties 7 (Caroline), 13 (Harford) and 14 (Howard) all surround Baltimore (Baltimore County also has a high percentage of third parties, with 2.34% of all VRAs coming from third parties) I suspect the increase in third party paper VRAs there may be due to college students who attend places in the Baltimore

[30] Note that in this analysis third parties include not only the recognized third parties of Green and Libertarian, but also any "Other" parties as indicated by the voter, which sometimes includes text indicating the voter actually wants to be unaffiliated. If an analysis on Maryland political parties were to be done in detail, distinguishing between recognized parties and other parties could be important.

region (Towson University, University of Maryland Baltimore, Loyola University, etc.). The data appears to support this, because in those three counties and Baltimore county, 37% of registrations came from the 18-25 year old age range but in the rest of the state combined only 29.8% of registrations came from the 18-25 year old range. This fits with the increase in third party OLVR applications in county 20 (Somerset) where University of Maryland Eastern Shore is located. Garrett County (county 12) also shows a high percentage of third party OLVR applicants; however, with only 40 total VRAs from third parties in Garrett County, that high percentage may simply be due to the small sample size.

A visual inspection suggests that third party voters may prefer either OLVR or Other methods, while they are probably less likely to prefer the MVA method. However, since statewide 26.4% of 18-25 year olds register as either unaffiliated or third party while only 21.5% of all other age groups register as either unaffiliated or third party, this observation may be influenced by the age factor: younger registrants prefer OLVR and younger registrants are more likely than other ages to register as third parties or unaffiliated. More data on age group follows in the next section.

Table 5 – Third Party Source of Registration Tests

Variable 1	Variable 2	Test Used	Alternate Hypothesis	p-value	Confidence interval
%VRAs_3rdPrty_Other	%VRAs_3rdPrty_MVA	2 Sample T Test	$\mu > 0$	<.0001	Lower bound .01653
%VRAs_3rdPrty_OLVR	%VRAs_3rdPrty_MVA	Mann–Whitney	$\mu > 0$	<.0001	0.00920,0.03166
%VRAs_3rdPrty_Other	%VRAs_3rdPrty_OLVR	Mann–Whitney	$\mu \neq 0$	.5098	-0.01201,0.00875

Running the tests confirmed the visual inspection: third party voters among paper applications are up to 1.7% higher than the percentage of third party voters at the MVA. Similarly, the percentage of third party voters among OLVR applications is between .9 and 3.2% higher than the percentage of third party voters among MVA applications. The difference between OLVR and Other VRAs is insignificant.

Figure 37 shows the same data for those who submitted a VRA and turned out to vote. As with all the other party plots, the values show less variance. Among registrants who turned out to vote, 3rd parties were 1 to 3% more likely to register using paper sources than the

MVA and 1.8 to 2.8% more likely to register using OLVR than the MVA. The difference between paper and OLVR registrations was insignificant.

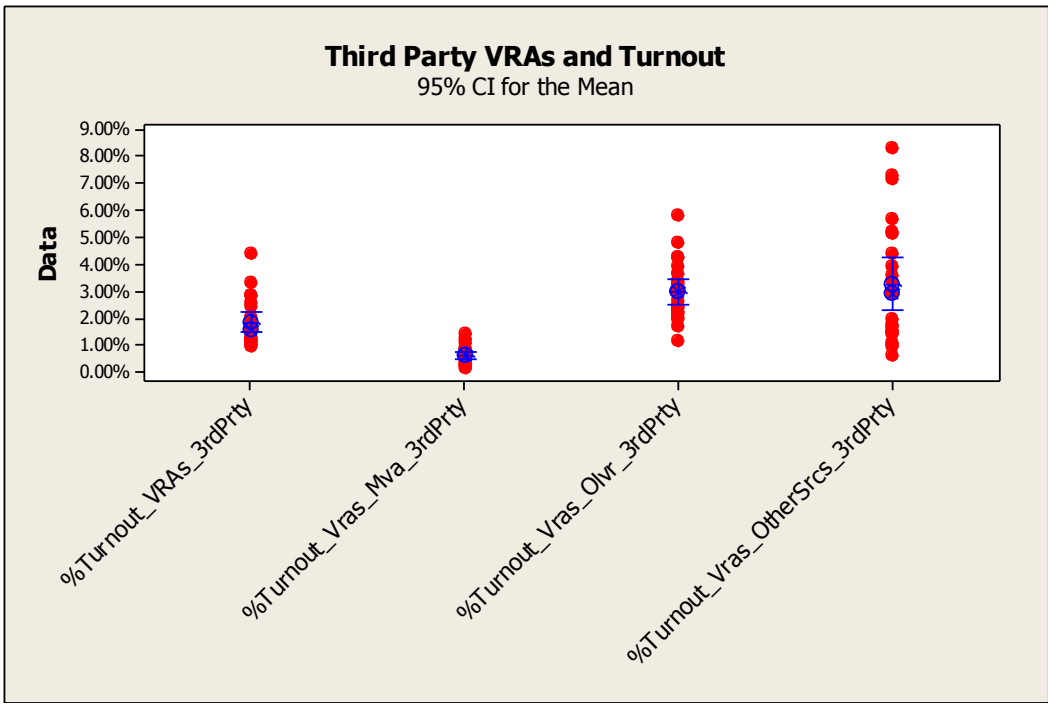


Figure 37 - Individual Value Plot: Third Party VRAs and Turnout

Age and Registration Source

18-29 Year Olds

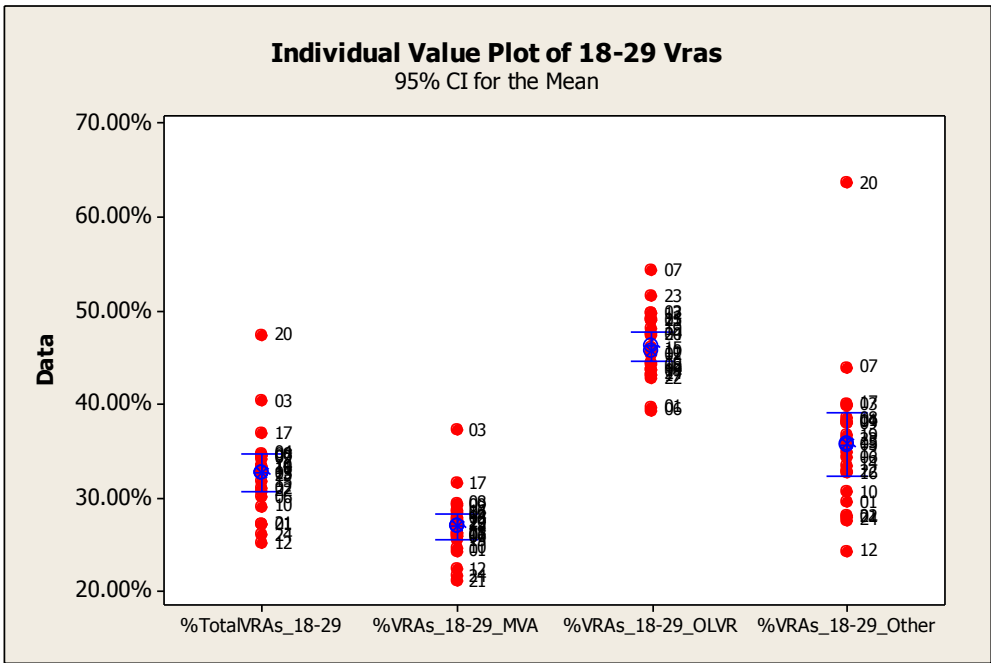


Figure 38 - Individual Value Plot: 18-29 Year Old VRAs

The first group in Figure 38 displays the individual values representing what percent of VRAs received in each county were received from 18-29 year olds. The following three groups represent what percent of VRAs from each of the noted registration sources came from 18-29 years olds. The graph shows that county 20, Somerset County, has an unusually high percentage of 18-29 registrants which supports the hypothesizes explanation for the unusually high percentage of females in that county: the University of Maryland Eastern Shore is in Somerset County, and the county is so small that the increase in registrations coming from college students is enough to show as unusual when compared to the rest of the state. County 7, Carroll County, seems similarly affected by this age group, which matches what was discovered in the third party section. The other jurisdictions affected by colleges have enough population that the additional population from college students is not significant enough to appear visually here. A visual inspection suggests that this age group has a strong preference for OLVR over other methods and is least likely to use the MVA for registrations, which would be logical for the younger in the age group who would not yet require a driver's license renewal and would also be very comfortable with technology.

Table 6 – 18-29 Year Old Source of Registration Tests

Variable 1	Variable 2	Test Used	Alternate Hypothesis	p-value	Confidence Interval
%%VRAs_18-29_OLVR	%VRAs_18-29_MVA	Mann–Whitney	μ > 0	<.0001	0.17301,0.21476
%VRAs_18-29_OLVR	%VRAs_18-29_Other	2 Sample T-test	μ> 0	<.0001	lower bound .0746
%VRAs_18-29_Other	%VRAs_18-29_MVA	Mann–Whitney	μ > 0	<.0001	0.05618,0.10798

Table 6 confirmed the visual inspection in all three of the cases: 18-29 year olds make up a higher percentage of OLVR VRAs than MVA VRAs by 17.3% to 21.5% and paper VRAs by 5.6% to 10.8%. Paper VRAs are also used by this age group more than the MVA VRAs by at least 7.5%.

30-49 Year Olds

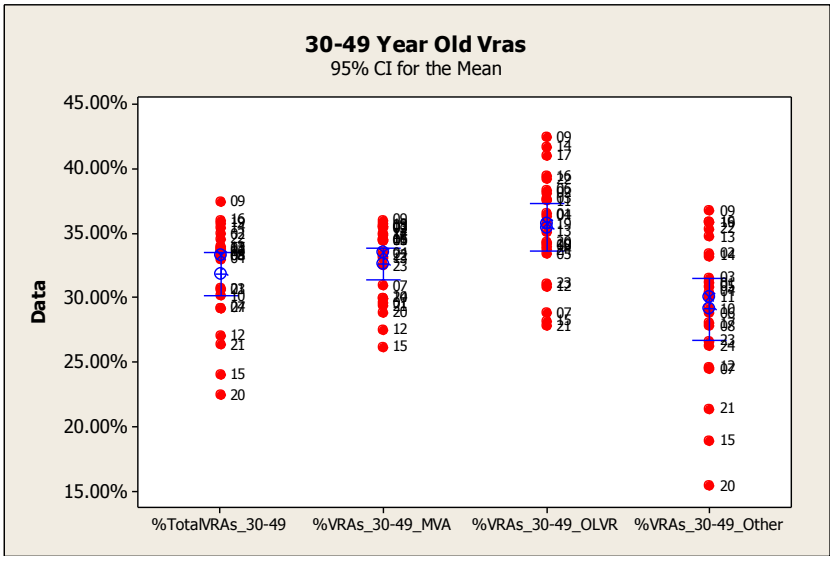


Figure 39 - Individual Value Plot: 30-49 Year Old VRAs

The first group in Figure 39 displays the individual values representing what percent of VRAs received in each county were received from 30-49 year olds. The following three groups represent what percent of VRAs from each of the noted registration sources came from 30-49 years old year old. These values do not show an obvious difference between overall percentage of VRAs and the MVA or Other methods, but suggest a preference for OLVR registration.

Table 7 – 30-49 Year Old Source of Registration Tests

Variable 1	Variable 2	Test Used	Alternate Hypothesis	p-value	Confidence Interval
%%VRAs_30-49_OLVR	%VRAs_30-49_MVA	Mann–Whitney	$\mu > 0$	.0094	0.00635,0.05022
%VRAs_30-49_OLVR	%VRAs_30-49_Other	Mann–Whitney	$\mu > 0$	.0001	0.02989,0.08946
%VRAs_30-49_MVA	%VRAs_30-49_Other	Mann–Whitney	$\mu \neq 0$	.0410	-0.05525,-0.00047

Running the tests in Table 7 – 30-49 Year Old Source of Registration Tests confirmed the visual inspection in three of the cases: the difference between the percentage of 30-49 year olds within OLVR VRAs and Other VRAs is anywhere from 3% to 9%. The difference between OLVR and the MVA is also significant, with anywhere from .6% to 5% more using OLVR. However, while the p-value for the difference between the MVA and Other methods is low enough to suggest statistical significance, it is still much higher than the p-value of the other two comparisons and the confidence interval is suggests that the trend is insignificant in some counties (as small as .05% higher use of paper) even though it can be as high as 5.5% in other counties. From this I conclude that while it is 30-49 year olds show clear preference for OLVR registration, it is not clear if they consistently prefer paper to the MVA because of the wider variation of values in the paper category.

50-64 Year Olds

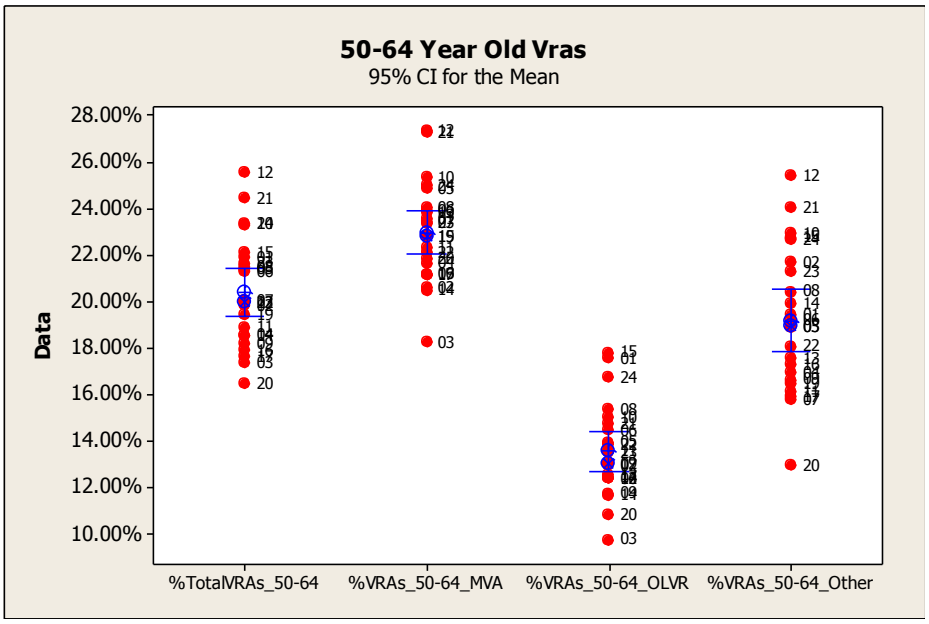


Figure 40 - Individual Value Plot: 50-64 Year Old VRAs

The first group in Figure 40 displays the individual values representing what percent of VRAs received in each county were received from 50-64 year olds. The following three groups represent what percent of VRAs from each of the noted registration sources came from 50-64 years olds. A visual inspection suggests strong preferences for MVA registrations among voters in this age group and OLVR registrations are the least frequently used.

Table 8 – 50-64 Year Old Source of Registration Tests

Variable 1	Variable 2	Test Used	Alternate Hypothesis	p-value	Confidence Interval
%%VRAs_50-64_MVA	%VRAs_50-64_OLVR	Mann–Whitney	μ > 0	<.0001	0.08205,0.10579
%VRAs_50-64_MVA	%VRAs_50-64_Other	Mann–Whitney	μ> 0	<.0001	0.02170,0.05479
%VRAs_50-64_Other	%VRAs_50-64_OLVR	Mann–Whitney	μ > 0	<.0001	0.03964,0.07240

Running the tests in Table 8 confirmed the visual inspection in all three of the cases: the differences are all significant, with MVA VRAs having 2.2% to 5.5% more 50-64 year old applicants than Other methods and 8.2% to 10.6% more than OLVR. Paper methods have a median difference of 4% to 7.2% more 50-64 year olds than OLVR does.

65+ Year Olds

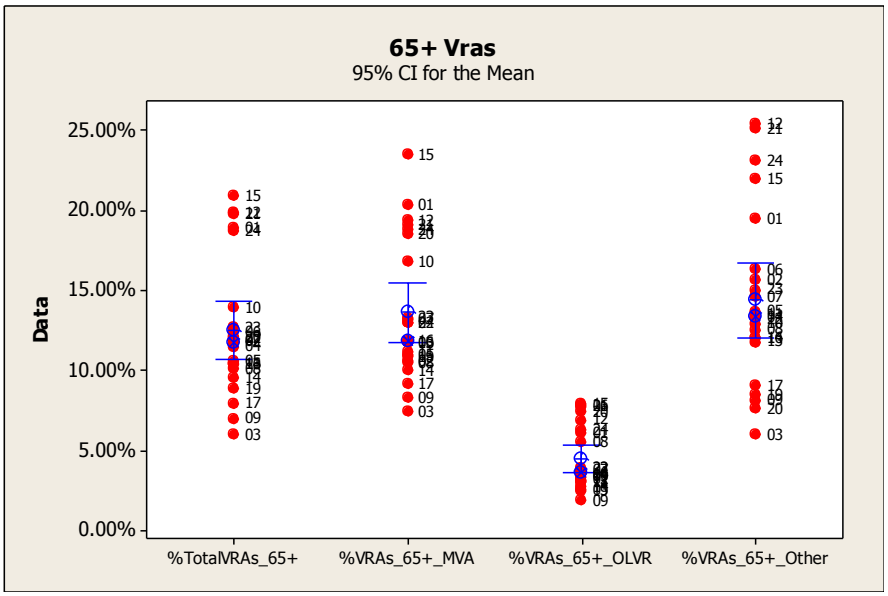


Figure 41 - Individual Value Plot: 65+ Year Old VRAs

The first group in Figure 41 displays the individual values representing what percent of VRAs received in each county were received from those 65 years of age and older. The following three groups represent what percent of VRAs from each of the noted registration sources came from that same age group. A visual inspection strongly indicates that, as with the 50-64 year old age group, those 65 and older tend to avoid the use of OLVR. However, the rest of the data appears widely varied with no clear indication of a difference between MVA and paper applications.

Table 9 – 65+ Year Old Source of Registration Tests

Variable 1	Variable 2	Test Used	Alternate Hypothesis	p-value	Confidence Interval
%%VRAs_65+_MVA	%VRAs_65+_OLVR	2 Sample T Test	$\mu > 0$	<.0001	Lower bound .07455
%VRAs_65+_MVA	%VRAs_65+_Other	Mann–Whitney	$\mu \neq 0$	<.0001	0.06829,0.10184
%VRAs_65+_Other	%VRAs_65+_OLVR	Mann–Whitney	$\mu > 0$	<.0001	0.06819,0.11127

Running the tests in Table 9 confirmed the visual inspection regarding OLVR use: the difference between the percentage of those 65 years and older within OLVR VRAs and those

of the same age group who registered using paper methods is from 6.8% to 11.1% lower and when compared to the MVA VRAs is at least 7.5% lower. The difference between the MVA and Other VRAs methods does actually show as significant, with the median difference showing MVA as 6.8% to 10.2% higher than paper methods.

Age in Other States

Due to limited data, I could only look at correlations between those over 65 and the registrations submitted by EMV and OLVR in other states. No correlation at all is visible between EMV applications and those over 65. The finding for population over 65 and Internet VRAs is interesting: Arizona, which has had OLVR since 2001, has absolutely no correlation; Kansas, which has had OLVR since 2009, shows a highly probable (p-value greater than .0001) negative correlation, although it has very wide variances suggesting the correlation is not highly significant; Maryland's correlation shows a p-value of .4, again with high variances, and slightly less of a slope than in Kansas. However, since the prior and more precise analysis in Maryland shows a very clear decrease in the use of OLVR by those over 65, the variances represented in this chart are likely due to other factors such as using population instead of registered voters and aggregate VRA counts that cannot be matched to the age of the voters. More research is necessary, but based on the fact that Arizona is highest on the graph and Maryland is clustered toward the bottom, I speculate that it would find that the longer a jurisdiction has OLVR the higher the percentage of the over 65 age group that would use the system.

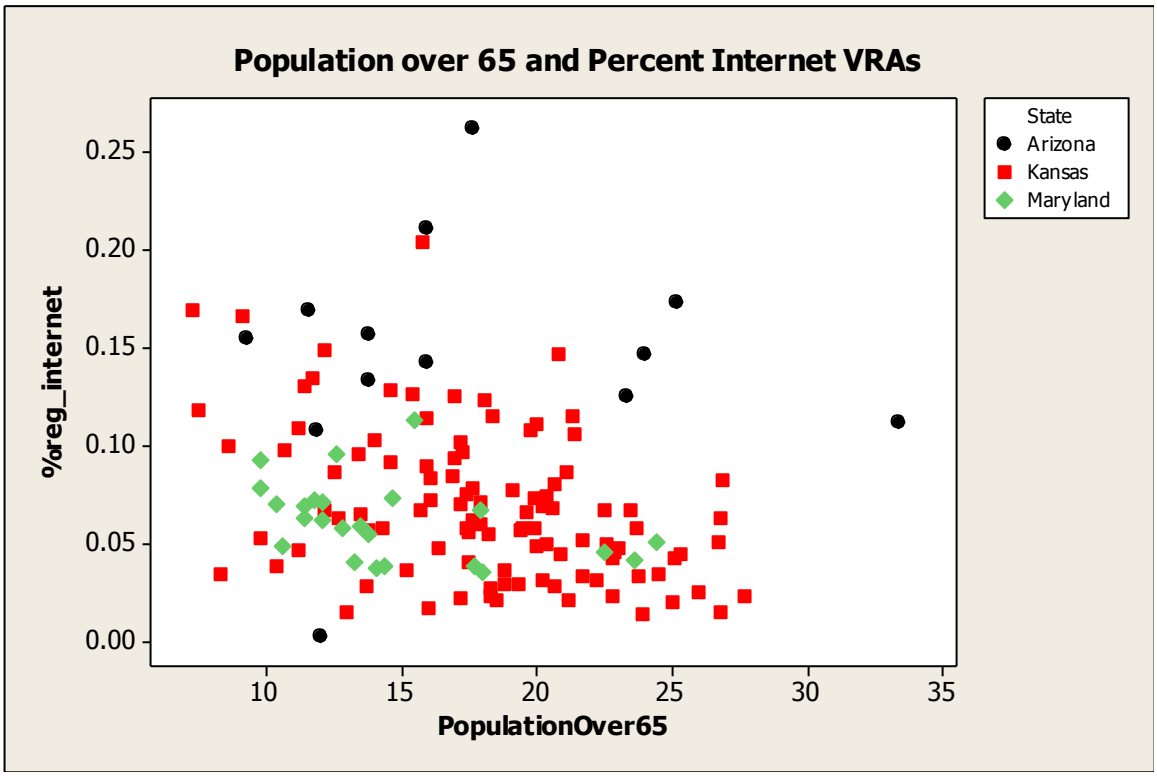


Figure 42 - Scatterplot: Population over 65 and Internet VRAs in Other states

Voting Age Turnout by Registration Source

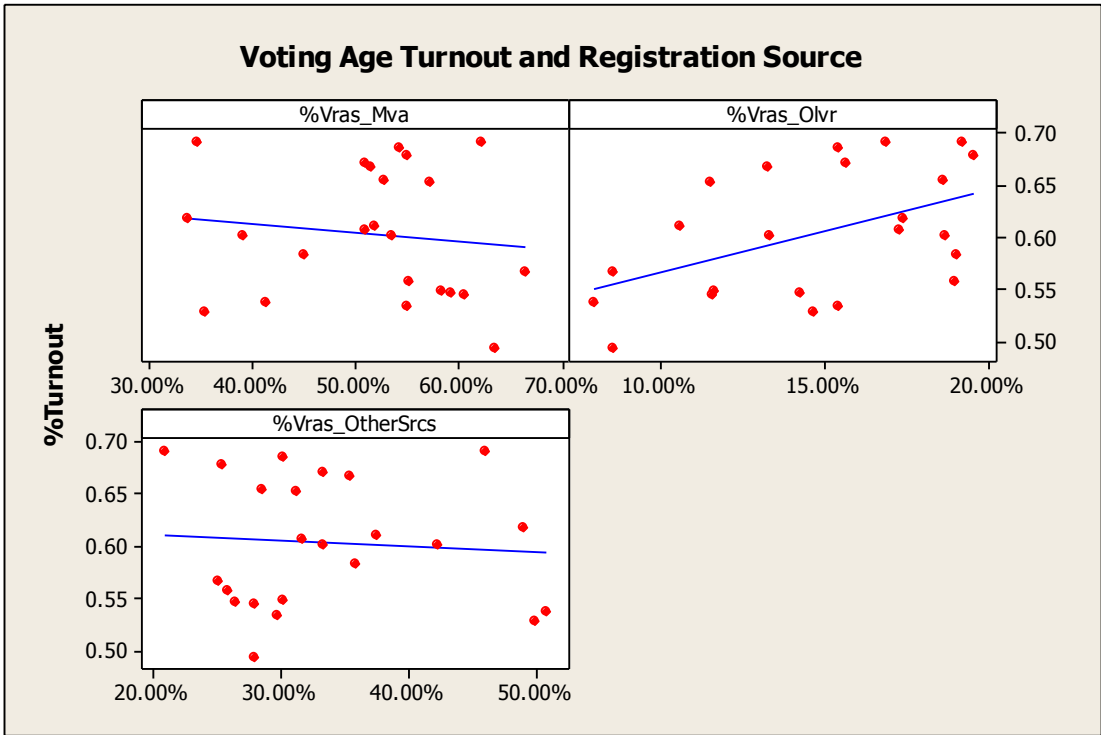
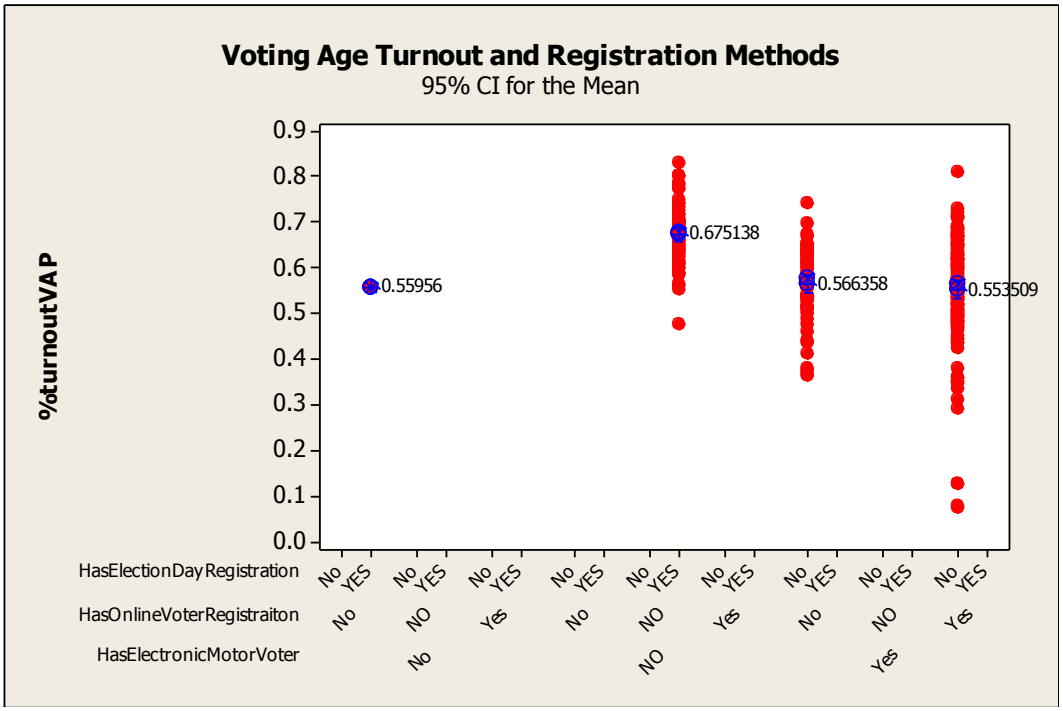


Figure 43 - Voting Age Turnout by Source of Registration

Figure 1 shows the correlation between Voting Age Turnout and the applicants received by source. No relationship exists between the percent of paper applications or MVA applications and the turnout percent. A very loose correlation shows for OLVR applications and turnout percent, enough to be noticeable, though not enough to be convincing. A regression analysis of that relationship shows a reasonable probability of a correlation ($p < .02$) and no unusual observations, but the variance is huge (r-squared is only 19.7%). However, the slope of the regression is .7922, making it an easy to use tool: although wide variances exist, to some extent turnout increases by .79% for every 1% increase in OLVR registrations.[31]



[31] After analysis was complete, it was discovered that the cutoff for the sample should have been July 9th instead of July 1st. That extra week of MVA and paper applications would not have been enough to change overall results, but might have been enough to push the slope of the OLVR to Turnout regression line closer to 1% instead of .8%. Further observation will be required in future elections.

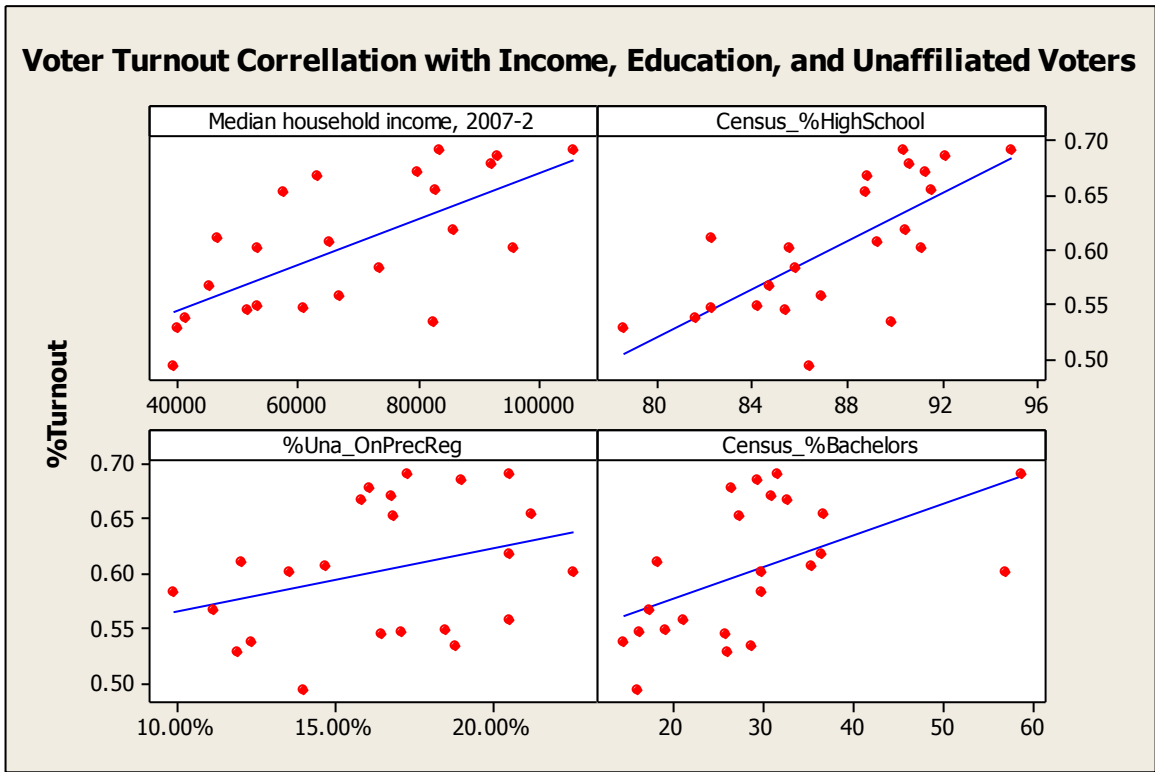


Figure 44 - Scatterplot: Maryland Voter Turnout With Median Income, Education, and Unaffiliated Voters

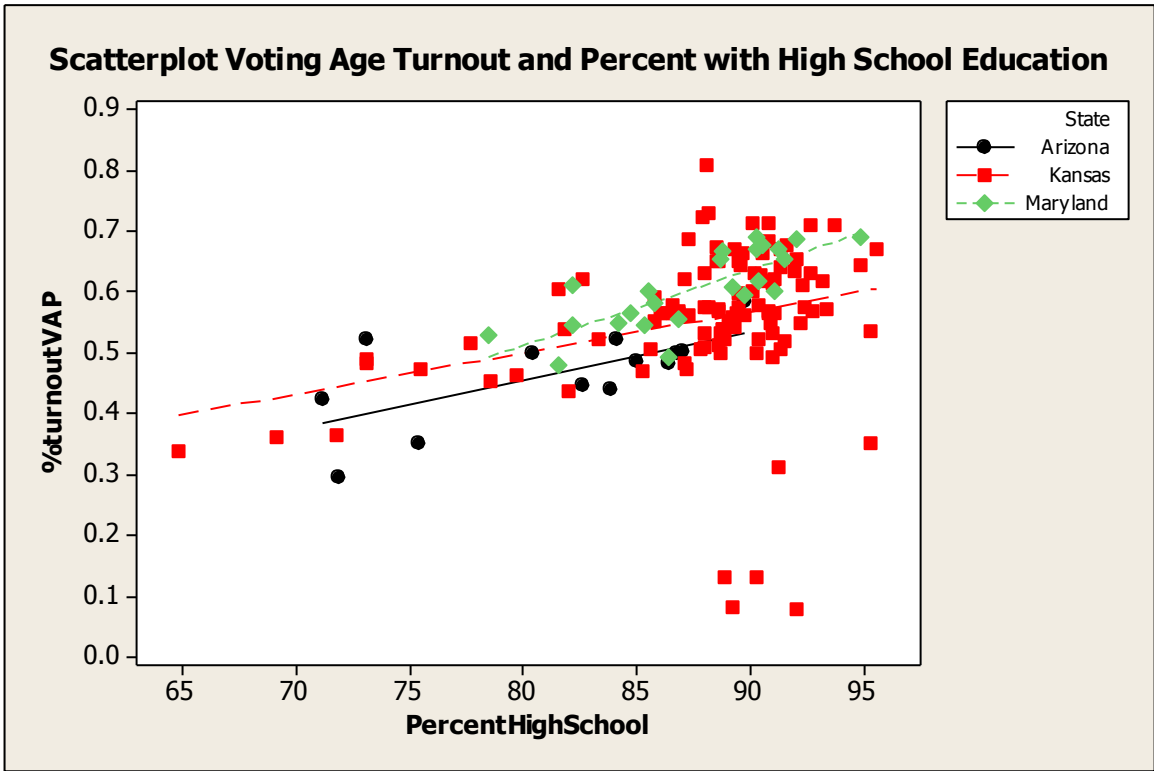


Figure 44 shows the four data points, other than OLVR registrations, available to this analysis that have the most correlation with voter turnout percentages. At a glance it is clear that the percentage of unaffiliated voters, like the percentage of applications from OLVR, while slightly correlated, is not strong. The variances are wide and unconvincing. A regression analysis confirms this, with a p-value of .12 indicating little to no real correlation.

Visually, high school education and median income have the tightest correlation, although it is possible that Howard County and Montgomery County are skewing down the regression in the plot of the percent of residents with a bachelors degree, because of their highly educated constituency.

A regression analysis gives a p-value of < .001 to the relationship of voter turnout with the percent of residents with a high school degree. The variances are wide (49.4% r-squared value), indicating other factors, but the relationship is strong enough to be meaningful. It must be noted that Allegany County, Baltimore City, and Somerset County have the widest variance. This may be because Somerset and Allegany are small enough that any variance in county has a strong impact, while Baltimore City is known for unusually low turnout, likely due in part to the lack of political competition in the jurisdiction. The regression for the Bachelor's degree is less convincing, with an r-squared of 25.6%, although as noted it is skewed by Howard County and Montgomery County.

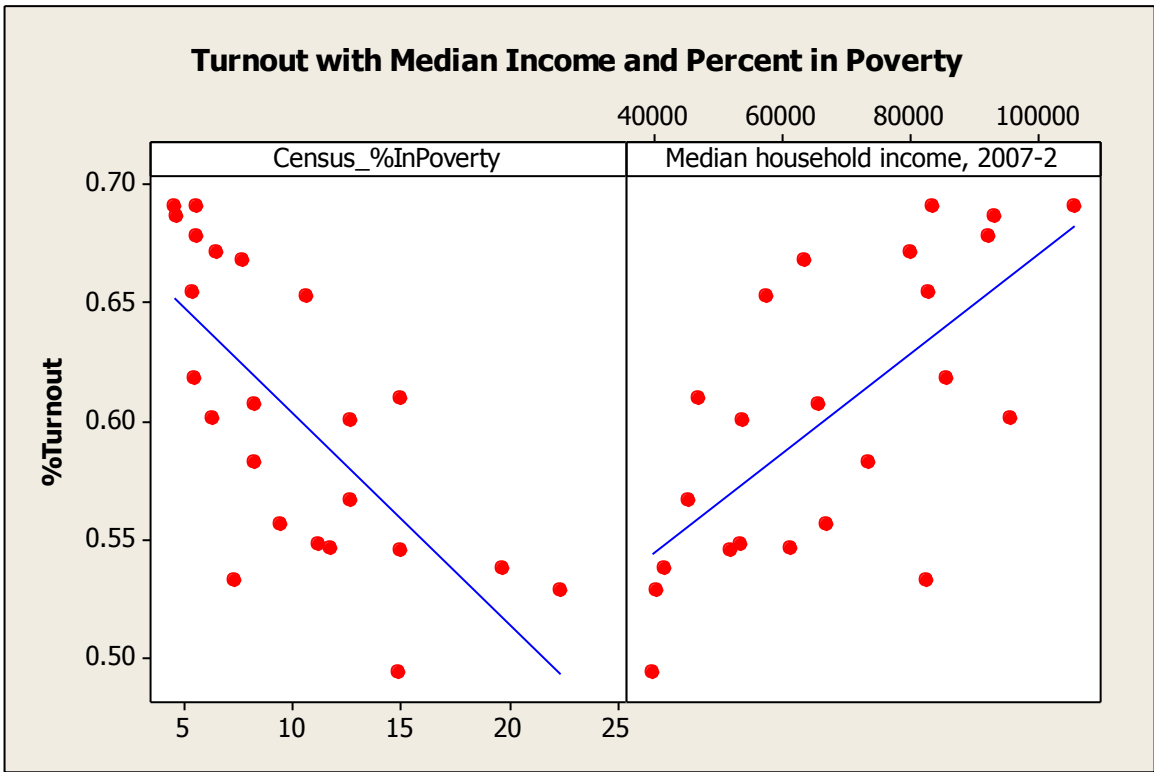


Figure 45 - Scatterplot: Turnout with Median Income and Percent in Poverty

Figure 45 compares the Median Income correlation with the percent in poverty. Naturally, those two numbers are not completely independent, but one may have more impact on turnout than the other. The regression analyses confirm that the residuals are smaller for the correlation with the percent in poverty (48.1% vs 43.8%), although both Baltimore City and Somerset County show as unusual observations, while on the Median Income regression only Somerset shows as unusual. Both have a p-value of less than .001. Therefore I conclude that either correlation would be appropriate, but that the fewer unusual observations of Median income make it the better variable to use in conjunction with High School education. It must be noted that Median Income and High School education are, as is logical, not independent variables.

The above analysis makes it clear that other factors such as education and income, while not absolute predictors of turnout, do have a tighter correlation with voter turnout than the use of OLVR does. However, could the use of OLVR be impacted by one of those variable, explaining the slight correlation evident in Figure 43? Figure 46 answers this with a strong positive. Both appear related, but Median Income has the tightest relationship.

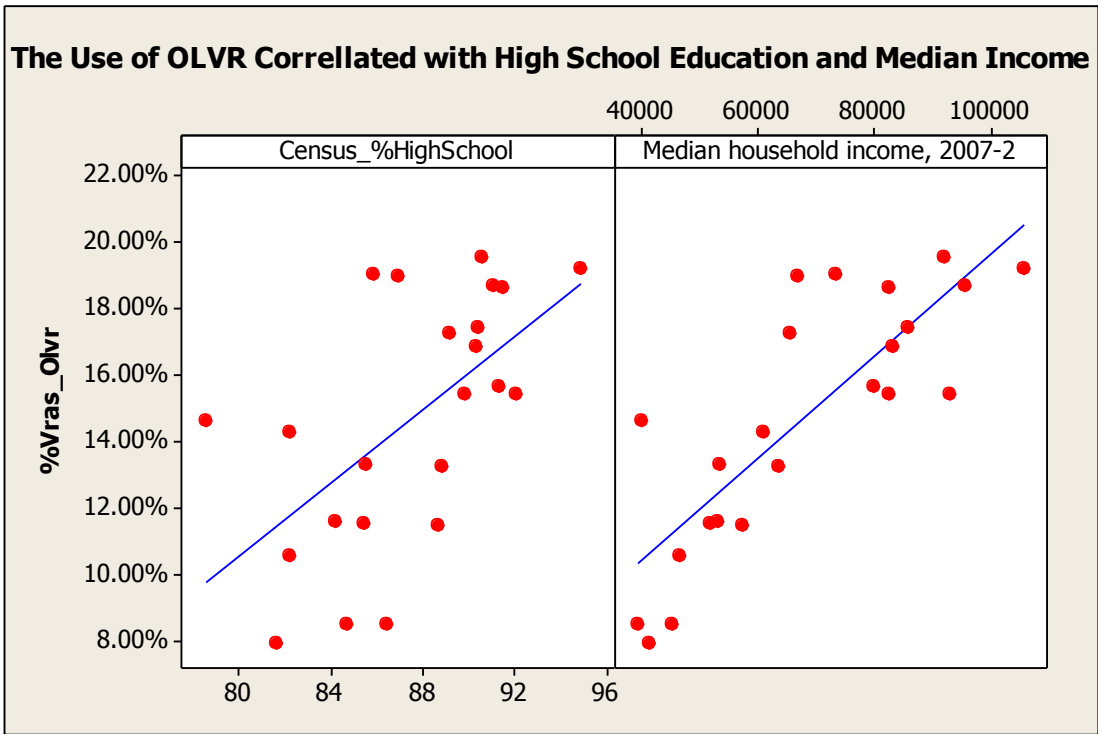


Figure 46 - Scatterplot: OLVR VRAs and High School Education and Median Income

A regression analysis of Median household income and the percentage of OLVR applications provides a p-value of less than .001 and moderate variances with an r-square value of 65.5%. Allegany County and Cecil County are listed as unusual observations.

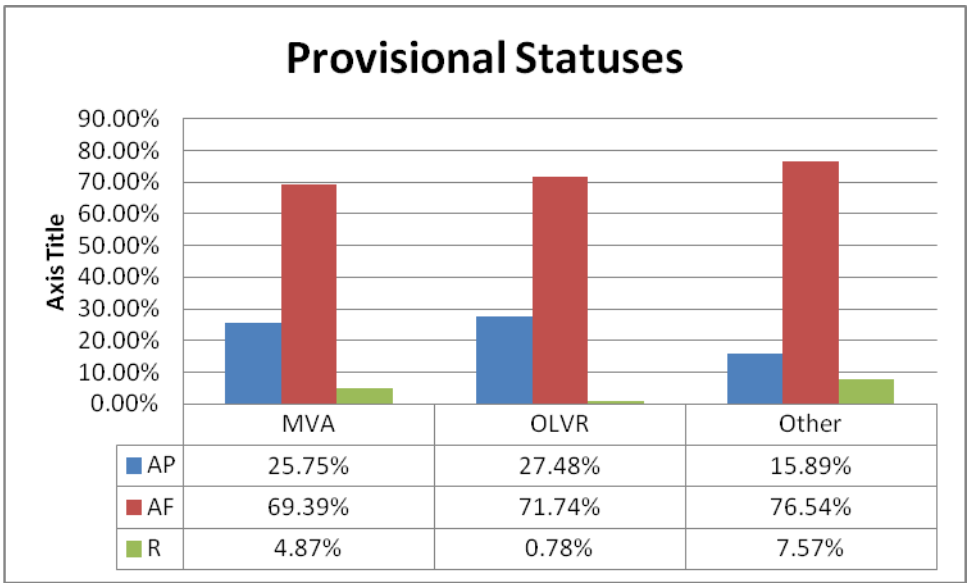
Because median income has some impact on turnout (along with high school education) and because median income and OLVR show a correlation, the question is if they work together to provide a tighter prediction of turnout or if the relationship between OLVR and turnout is purely incidental to the Median Income of the county. A regression analysis suggests the latter, because when using both Median Income and OLVR as variables, the slope of the line decreases and the residuals are slightly larger.

Provisional Ballots and Registration Source

Statewide Provisional Ballot Statuses

Figure 49 displays the percentage of provisionals by status for the whole state. By far the highest percentage in any category are of ballots that were Accepted-in-Full and rejected

ballots were the least common. However, a higher percentage of ballots were rejected after registration using paper than any other method.



	MVA	OLVR	Other
AP	25.75%	27.48%	15.89%
AF	69.39%	71.74%	76.54%
R	4.87%	0.78%	7.57%

Figure 47 - Provisionals by Status and Registration Reason[32]

Total Provisional Ballots Cast

Because the LBEs were reportedly able to complete all data entry prior to the precinct register pull, the only way MVA VRAs could have caused an increase in provisional ballots, as the locals believed, is if the data on the MVA applications was erroneous enough to cause a significant number of invalid voter merges (resulting in a "nonregistered" voter who previously had been registered) or a significant number of invalid residential address (resulting in voter going to their polling place only to find they were assigned to vote elsewhere). If one or both of these were true for any registration source, the regression should show a positive correlation between the percent of VRAs received (from all sources except provisional ballots) from a given registration source and the percent of provisional turnout. Figure 48 displays those results.

[32] AP refers to Accepted in part, AF is Accepted in Full, and R is Rejected.

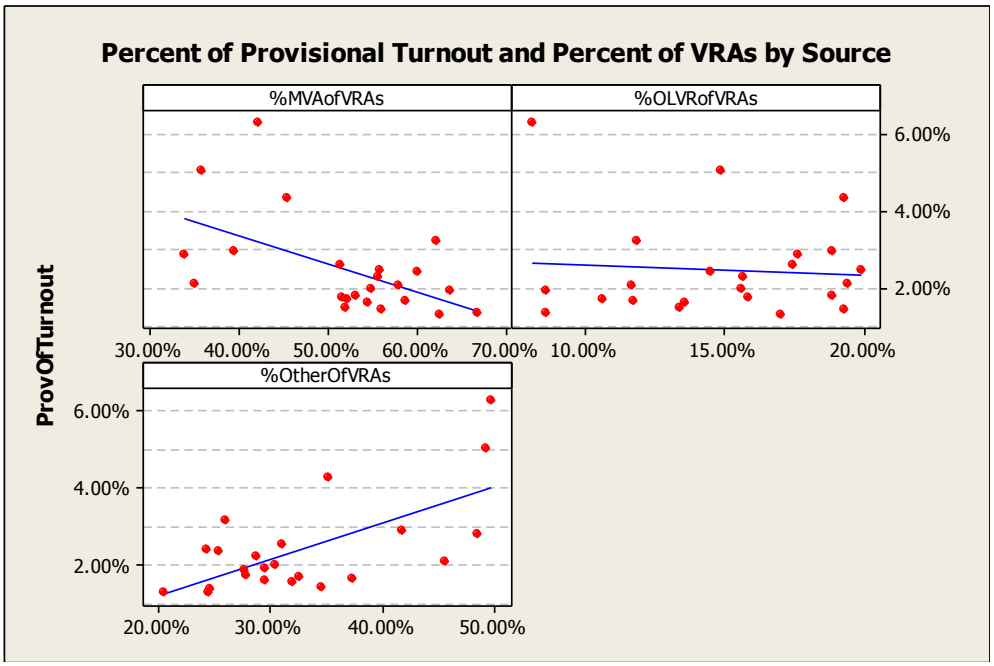


Figure 48 - Percent of Provisional Turnout Correlated to the Percent of VRAs by Source

The percent of OLVR VRAs show no correlation while the percent of MVA VRAs actually shows a negative correlation with provisional turnout. The slope is -.0742, which means that for every 1% increase in MVA VRAs provisional turnout reduces by .0742%. While this may seem insignificant in other applications of a regression, in this case it is promising, because provisional turnout at the local level ranged between 1.5% to 6%. However, the regression analysis shows a poor fit, with a p value of .006 but an r-squared value of 27.7%.[33] Further it must be noted that provisional turnout increases as turnout increases, and since as MVA applications increase turnout decreases the correlation seen here may simply be a factor of turnout in general and may not reflect any improvements to the voter registration process as a result of the MVA voter registrations.

Conversely, an increase of provisional ballots is loosely correlated with an increase in paper VRAs. A regression analysis shows a p value of .001 and an r-squared value of 38.9%, with a slope of.09783. So while the correlation suggests that for every 1% increase in VRAs

[33] Somerset County shows as an unusual observation because of its high variance from the regression line, but its value is not so unusual as to alter the overall correlation.

from paper sources provisional turnout increases by .097%, the variances between the counties are still too wide for this to be a useful statistic.

The regression lines when comparing only those non-provisional applicants who voted provisionally are essentially unchanged from those in Figure 48; an increase in the percentage of MVA applications shows a decrease in provisional turnout while an increase in the percentage of other applications shows an increase in provisional turnout.

The SBE expectation was that OLVR and EMV would reduce data entry errors and improve the speed with which VRAs could be processed, resulting in the need for fewer people to vote provisionally. However, one major factor appeared to prevent this from being apparent for the OLVR VRAs: OLVR accounted for only 17% of all VRAs statewide during the time period because the MVA sent such a large amount and because of other sources such as petitions (see Figure 49). It simply was not a large enough percentage of applications to make any real impact on the provisional ballot turnout percentages.

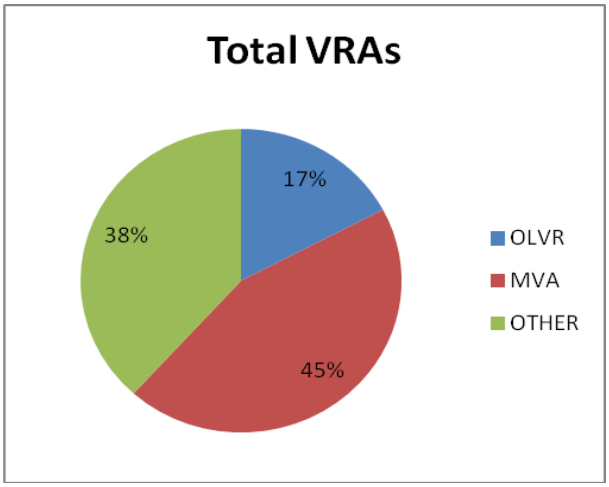


Figure 49 - Total VRAs by Source

A better determination of the effect the various VRA sources had on provisional turnout is to see how many voters who submitted new VRAs had to vote provisionally. The median of the percent of applicants who had to submit a provisional ballot, by registration source, shows in Figure 50. While Somerset County is again an outlier, the results confirmed the expectation: while only 1.7% of all OLVR applicants had to vote provisionally and only 2.04% of MVA applicants had to vote provisionally, 4.01% of paper applicants had to vote provisionally.

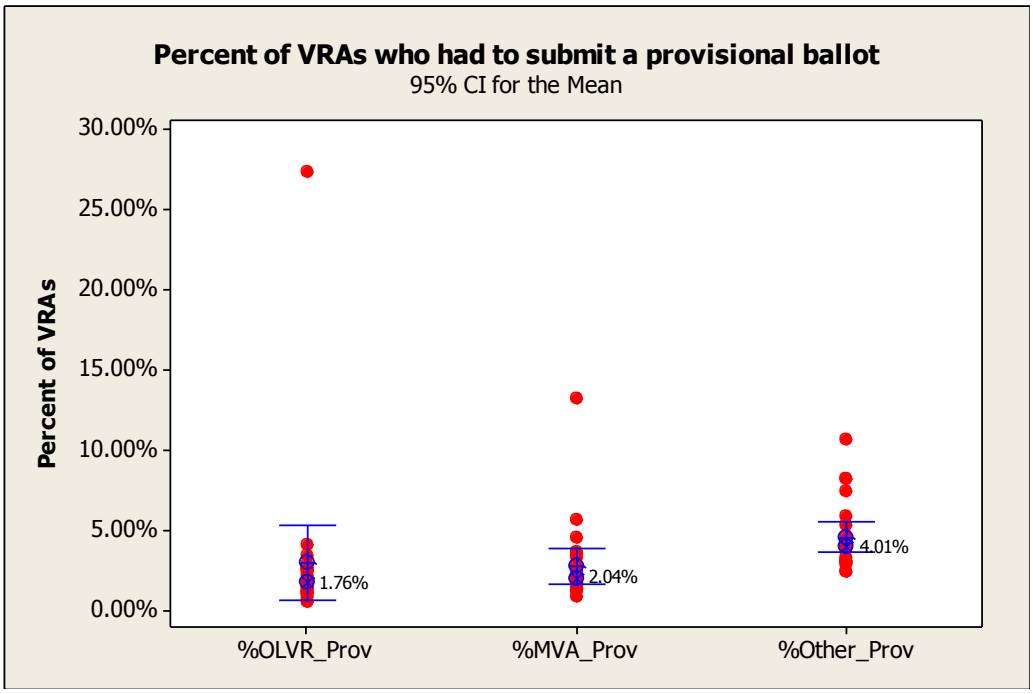


Figure 50 - Percent of VRAs who had to submit a provisional ballot

While an increase in OLVR VRAs did not cause an increase in provisional turnout, they also cannot be said to have reduced it significantly because the overall percentage did not significantly change as a result of those applications. However, it is clear that voters who use OLVR to registered are more likely to be registered on time and in the correct than paper methods are[34]. The EMV process, despite the difficulties in the initial implementation, showed a loose but likely negative correlation with provisional turnout and also those who submitted an EMV application were less likely to need a provisional ballot application than those who submitted a paper application.

[34] Further research is required to understand why someone who submitted an application on paper would be assigned to the wrong precinct; however, two possibilities to consider are that 1) paper is slower and therefore voters may not be notified of their change in polling place in as timely a fashion and 2) petitions may create more inadvertent changes of address than is currently known.

Other States

When comparing the EAC data of other states to the EAC data of Maryland in order to find any correlation between EMV registrations and provisional turnout, it was apparent that the Maryland EAC data does not show the expected negative correlation. This is likely because, as noted previously, the EAC numbers are calculated using total transactions and not counts of applications. Therefore, while the plot suggests no correlation in Florida, a possible negative one in Arizona, and a possible positive one in Kansas (Figure 51), the data is likely not precise enough to portray any useful information for this application. The EAC data is equally uninformative for the question of provisional turnout and Internet registrations (Figure 52).

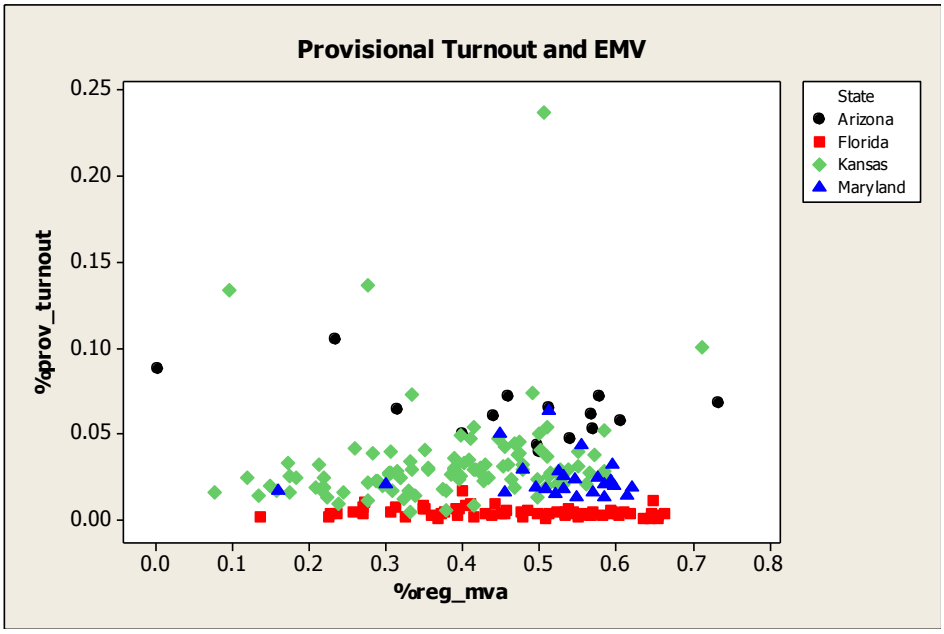


Figure 51 - Scatterplot: Other States Provisional Turnout and EMV

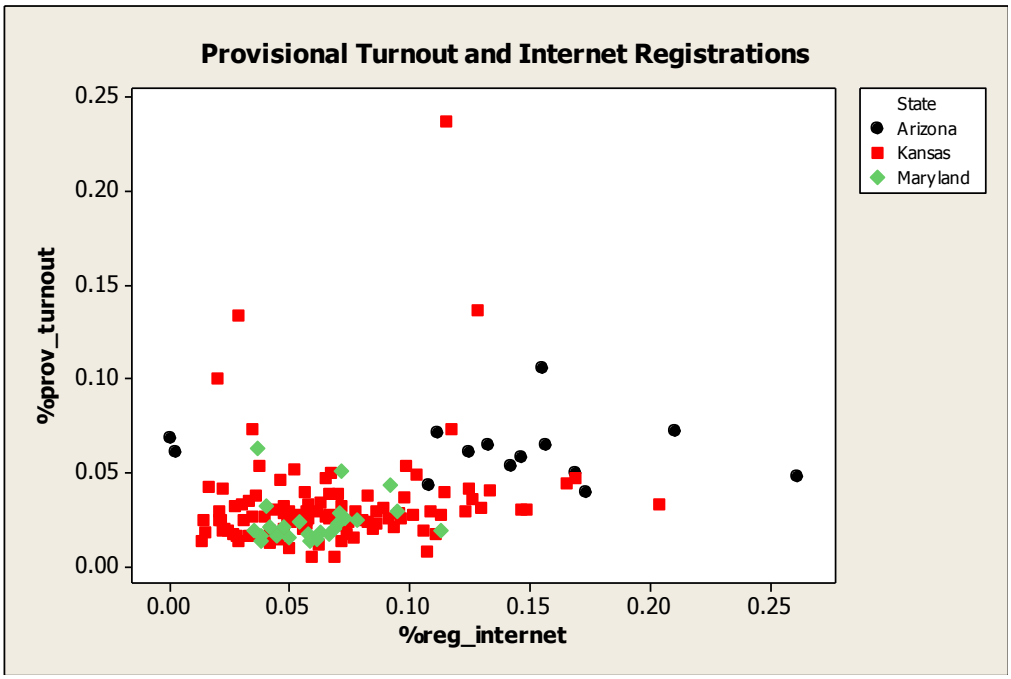


Figure 52 Scatterplot - Provisional Turnout and Internet Registrations

Rejected Provisionals and Registration Source

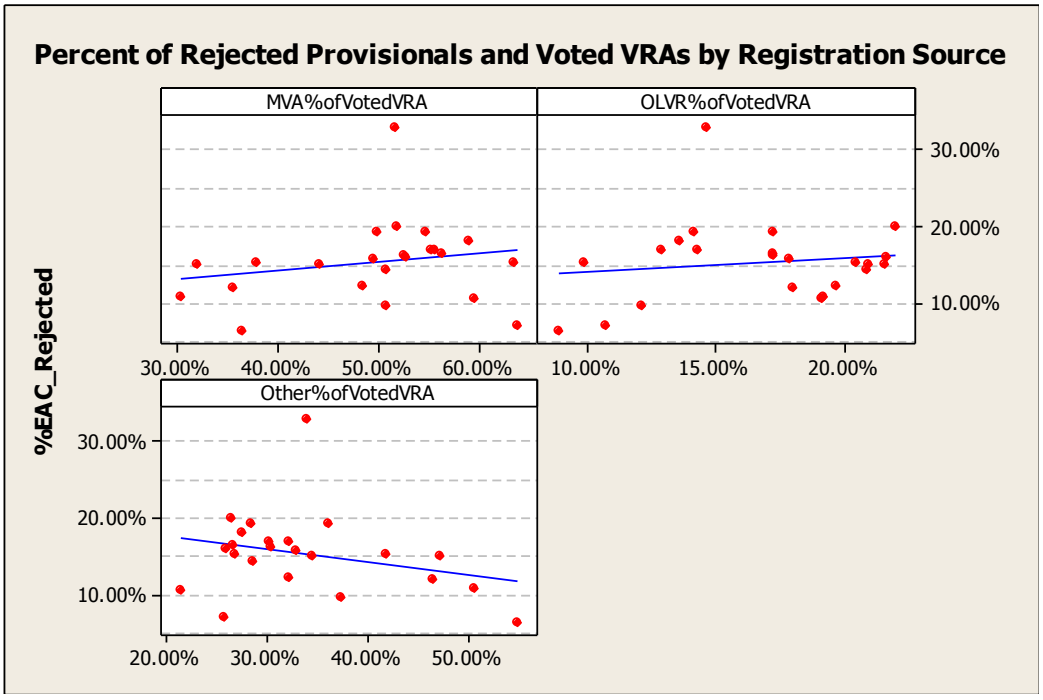


Figure 53 - Scatterplot: EAC Rejected and Voted VRAs

Figure 53 shows the correlation between the percent of provisionals which were rejected and the percent of applicants who voted. However, despite the suggestion of a

negative correlation for Other applications and a positive one for the EMV applications, a regression analysis shows no statistical likelihood to the correlations. A better perspective is provided in Figure 54, which shows that of those who voted and had to vote a provisional ballot, less than 1% of OLVR applicants were rejected while 5.9% of EMV provisionals were rejected and 7.41% of Other provisionals were rejected. Since it is not possible to know how many of the provisionals marked with "MVA" as a source of registration came through EMV versus a paper process, it is not possible to say if the increase in rejected provisionals through MVA as compared to OLVR is a result of process problems or the small number of paper applications which still came through from the MVA; however, the "other" categories still show a greater likelihood of being rejected than provisionals cast by those who applied through the MVA or OLVR.

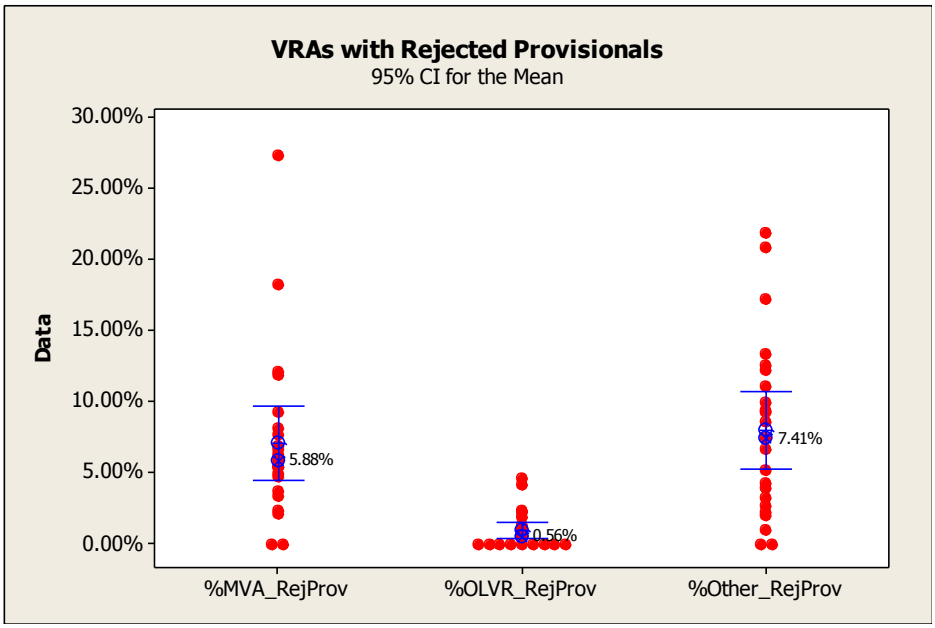


Figure 54 - Individual Value Plot: VRAs with Rejected Provisionals

Scatterplots of rejected provisionals with the percent of EMV VRAs (Figure 55) and the percent of Internet VRAs (Figure 56) from the EAC data also shows no correlation between source of registration and the percent of provisionals cast. While the plots suggest some interesting differences in the way the states implement provisional balloting and

counting (notice the increase of rejected provisional applications from Kansas compared to Arizona and Maryland), the EAC data is not precise enough to answer the question raised here.

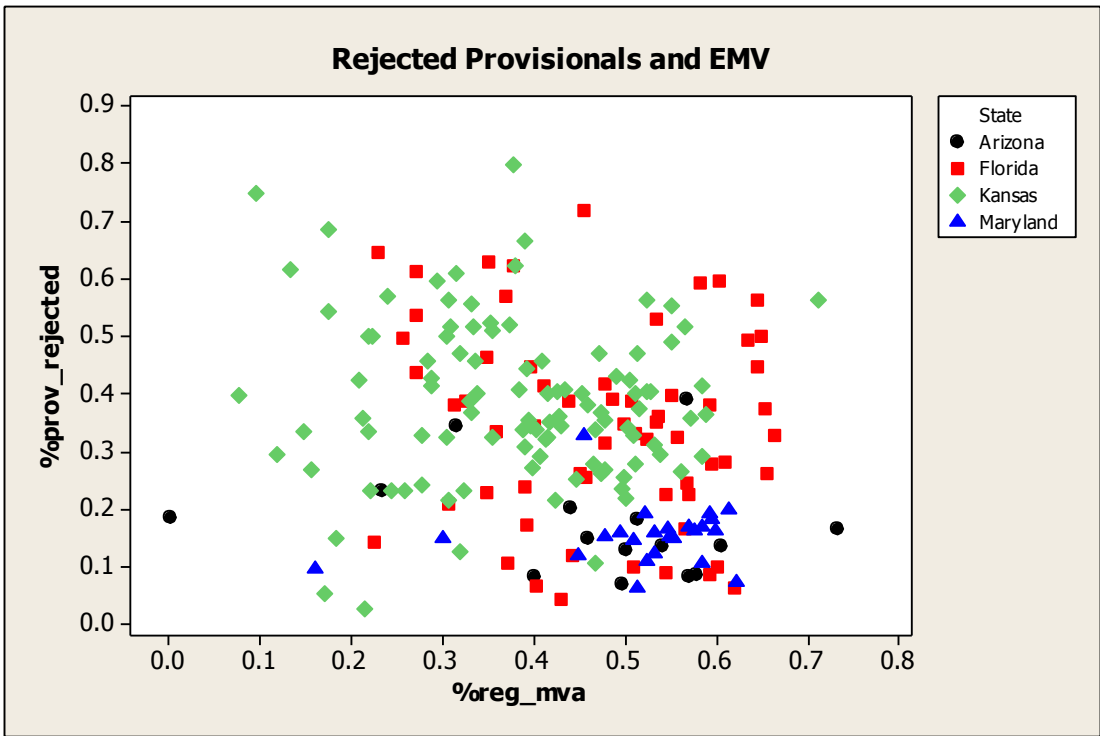


Figure 55 - Other States Rejected Provisionals and EMV

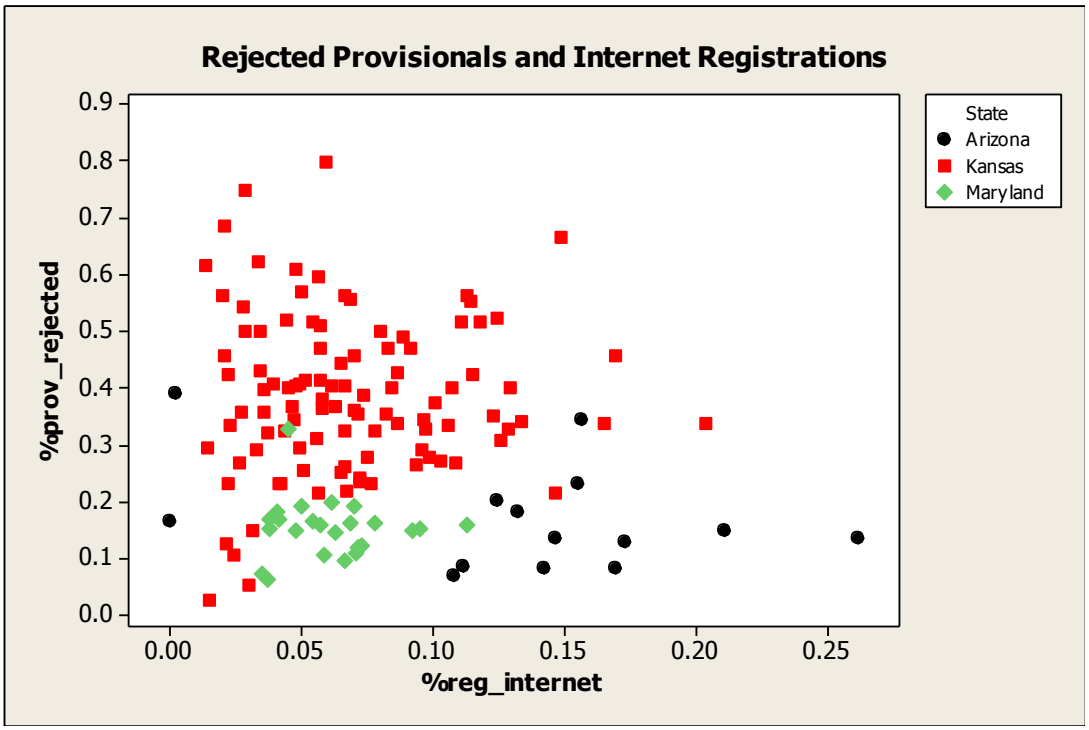


Figure 56 - Other States Rejected Provisionals and Internet Registrations

More interesting is Figure 57, which plots all values for those jurisdictions where the percent of rejected provisionals is greater than 0 and less than 100%.[35] For those jurisdictions with neither EMV nor OLVR, the mean of rejected provisionals is significantly higher than those jurisdictions which have one or both. Similarly, more provisionals are rejected in jurisdictions with OLVR only when compared to those with both OLVR and EMV.

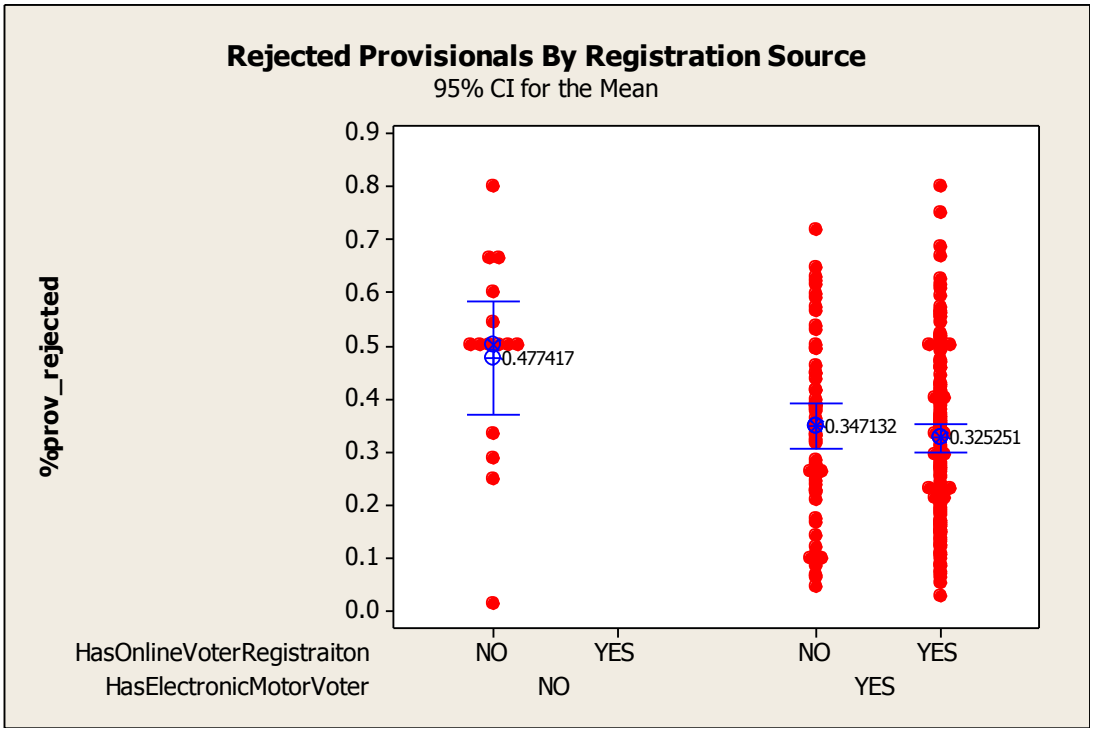


Figure 57 - Individual Value Plot: Percent of Provisionals Rejected Grouped by States which Have EMV or OLVR

Rejected for NonRegistration

Hypotheses 6, 7, and 8 all relate to my expectation that the EMV registration process would register people more effectively than the prior paper MVA process. However as with overall rejections, no correlation exists between the percent of rejected provisionals for reason of not registered and the percent of applicants from a given registration source who voted. However, Figure 58 shows that less than 6% of the MVA applicants and only 2% of OLVR applicants who had to voted provisional and were rejected were rejected for not being a

[35] The two extremes are eliminated from this and other EAC provisional analysis because some jurisdictions have legal differences which result in all provisionals being accepted or all being rejected. Eliminating those prevents unreliable skew, although it does not provide a perfect comparison.

registered voter. The percentage of rejections from those with paper applications varies widely by county. A spot check of 10 of the "not registered" provisionals from the MVA revealed applicants who had been cancelled due to an out-of-state move, a felony conviction, a bounced voter notification card indicating an invalid address, or similar issues which were not resolved in a timely fashion by the voter, despite notifications from the local board.

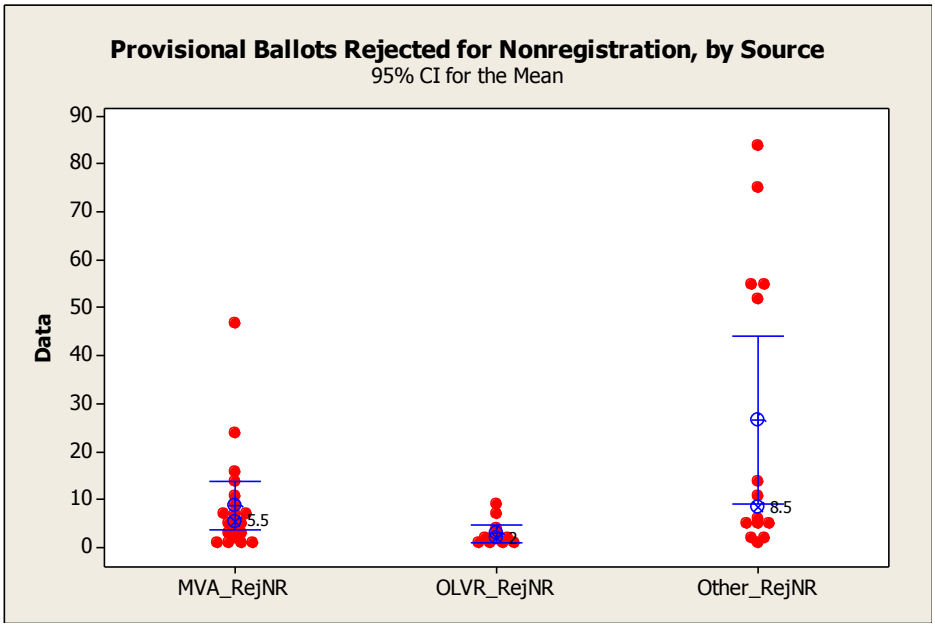


Figure 58 - Individual Value Plot: Provisional Ballots Rejected for Nonregistration, by Source

Perhaps the most telling statistic is simply counts. Table 10 gives the counts of rejected provisionals for the reason of nonregistration. While the largest numbers are in the paper applications, in no category is it a large number. Further, because my query made the assumption that no untimely registrations were being entered until after the election closed, it is possible that some of these represent untimely applications. Without further research it is not possible to determine if the numbers here reflect untimeliness on the part of the voter registration application or a process breakdown in voter registration, but the small spot check suggests true problems are rare.

Table 10 - Counts of Ballots Rejected for NonRegistration

County	MVA_RejNR	OLVR_RejNR	Other_RejNR
Allegany	5		
Anne Arundel	16	2	14
Baltimore City	11	7	55

Baltimore County	7	2	52
Calvert		2	
Caroline	1		2
Carroll	6		
Cecil			5
Charles	3		6
Dorchester	1		
Frederick	9		
Garrett	1		
Harford	5	1	5
Howard	7	4	11
Kent	1		
Montgomery	47	9	75
Prince George's	24	3	84
St Mary's			1
Somerset	3	1	
Talbot		1	
Washington	2		5
Wicomico	7	1	1
Worcester	14		2

Another reason provisionals may be rejected is for problems with the voter's ID, for example, if the voter provided a 4 digit SSN and it did not validate with the Social Security Administration prior to the final canvass. Records from OLVR which did not validate would have been UOCAVA VRAs for which the voter provided a four digit SSN. MVA registrations which did not validate are not understood by the SBE staff, since the data which comes from the MVA should be valid; however, sometimes a registration would be provided through the EMV interface and would then not validate in the voter registration system when checked against the MVA link. That category could also represent the handful of paper applications through the MVA and may be an indication of ID typo on the part of either voter or data entry clerk. Figure 59 shows the percentages of this type of registration, showing very low percentages of rejections from OLVR and MVA and widely varied results in the Other category. The actual counts in Table 11 show the reason for the wide variances: small counties sometimes have no rejected ballots or none with an ID problem. Prince George's County shows an unusually high percentage of provisionals rejected for ID problems, and the number is also high. A post-election audit of Prince George's County found that they did not process SSA verifications during canvass as required, resulting in unnecessary rejections.

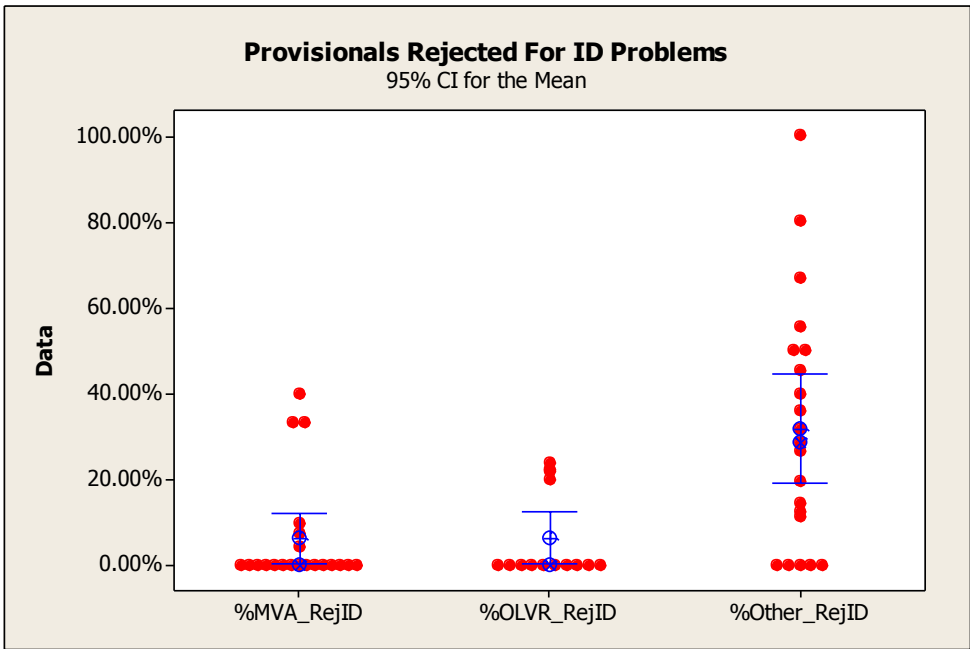


Figure 59 - Individual Value Plot of Provisionals Rejected for ID Problems and Source of Registration

Table 11 Counts of Provisionals Rejected for ID Issues

County	MVA_RejID	OLVR_RejID	Other_RejID
Allegany			
Anne Arundel		1	3
Baltimore City	1		29
Baltimore County	2		45
Calvert			
Caroline			
Carroll			
Cecil			2
Charles			5
Dorchester			4
Frederick			2
Garrett			
Harford			1
Howard		2	7
Kent			1
Montgomery	7	5	63
Prince George's	30	5	162
St Mary's	2		4

Somerset			1
Talbot	1		
Washington			1
Wicomico			
Worcester	0	0	4

Accepted in Part Provisionals and Registration Source

Figure 60 and the corresponding regression test show no correlation between the MVA applications and accepted in part provisionals. OLVR does show a slight negative but a very low r-squared value of 24.2 indicating a very wide variance. Similarly, paper applications show an increase of accepted in part provisionals, but again with a wide variance. Somerset County, which has an unusually high percentage of accepted in part absentees due to the local college, shows a large residual value for all three VRA sources; in fact, removing Somerset reduces any little correlation that may exist.

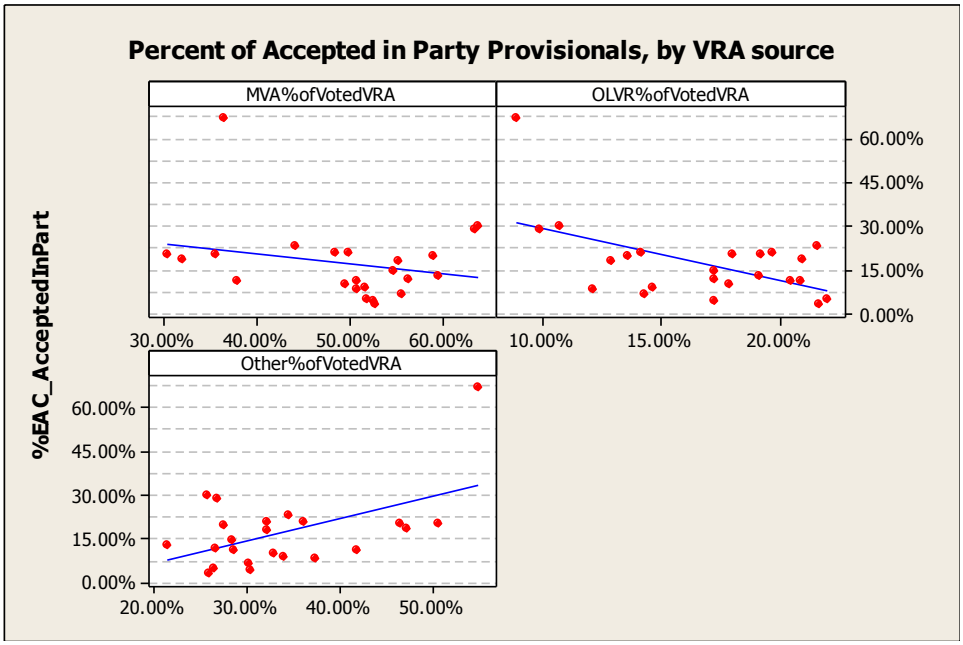


Figure 60 - Percent of Accepted in Provisionals, by VRA Source

Because no real correlation exists between the percentage of accepted in part provisionals and the percent age of VRAs from a given source, it is valuable to look at what percentage of those who submitted a VRA and voted had to vote a provisional that was accepted in part. Figure 61 shows the mean percent of accepted in part provisionals for the

voters who submitted VRAs and voted provisionally. The other category has the lowest percentage of Accepted in Part provisionals. However, the distributions are quite varied by county. Counts are again useful; Table 12 shows those counts, which shows again very small numbers in some counties.

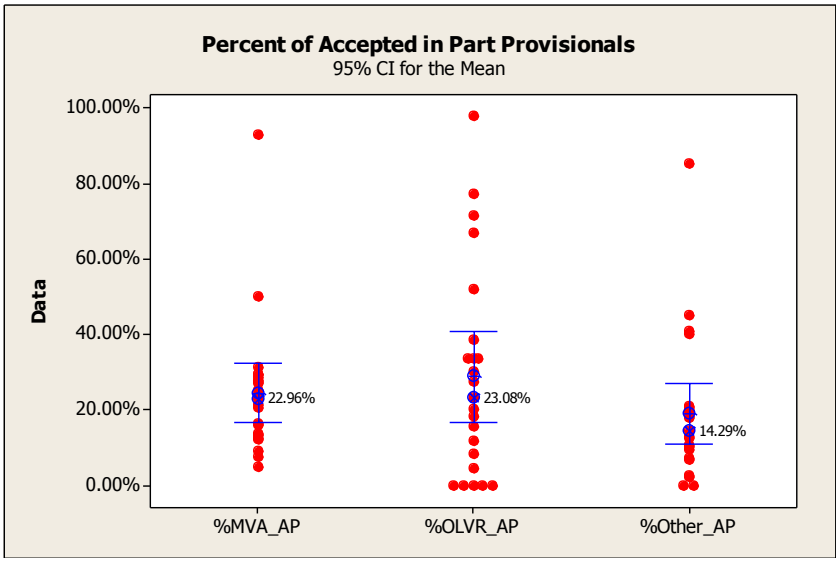


Figure 61 - Individual Value Plot: Percent of Accepted in Part Provisionals

Table 12 - Counts of Accepted in Part Provisionals

County	MVA_AP	OLVR_AP	Other_AP
Allegany	31	8	22
Anne Arundel	131	28	180
Baltimore City	333	81	378
Baltimore County	233	109	261
Calvert	5		6
Caroline	5		
Carroll	18	3	13
Cecil	4	2	3
Charles	17	2	3
Dorchester	2		
Frederick	27	8	16
Garrett	4		11
Harford	29	3	24
Howard	55	22	50

Kent	1	1	2
Montgomery	167	76	211
Prince George's	528	161	472
St Mary's	15	26	22
Somerset	78	41	87
Talbot	3	3	4
Washington	4		2
Wicomico	31	27	28
Worcester	11	5	5

A common question at the SBE is "how many of those Accepted in Part provisionals are convenience voters?"[36] Unfortunately there is no sure way of answering this question, since convenience voters are treated the same as any other voter who votes out of precinct. However, a spot check of 10 voters with an accepted in part provisional showed that no change was made to their address after voting, suggesting either confusion on the part of the voter regarding which polling place to use[37] or intentional convenience voting. It must also be noted that in the event that a voter went to the wrong polling place and yet was provided the same ballot style, that voter would have an accepted-in-full ballot. So both types of Accepted provisional in Maryland may represent convenience voters or those confused regarding their polling place rather than any voter registration problem.

Polling Place Turnout and Source of Registration

A scatterplot of the ballots cast and VRAs (including those VRAs from a provisional ballot) by source of registration suggests a positive correlation between OLVR and MVA VRAs and a negative one with all other VRAs. A regression analysis indicates that the

[36] Because Maryland allows accepted-in-part provisionals even across county jurisdictions, it is theorized the some voters choose to vote where they work instead of where they live. Those ballots would be provisional and would then have an accepted-in-part status.

[37] Maryland did extensive reapportionment between the 2012 primary and general elections, in accordance with legislative district changes following the U.S. Census. In some areas, particularly in Anne Arundel County and Baltimore City, voters who had used one polling place for years were moved to new polling places. While notification was sent, not all voters were aware of the changes, as noted by those who answered telephone calls on election day.

negative correlation with other types of VRAs is too varied to be useful, because despite a low p-value, the r-squared value is only 28.3%. The MVA regression has an r-squared value of only 14.1%. The p-value of the OLVR regression indicates no correlation between OLVR VRAs and polling place ballots. Figure 63 shows the same data for other states and again finds no correlation, although it highlights the difference in voting method choice in Arizona versus in Maryland and Kansas; and a test for EMV correlation also found nothing.

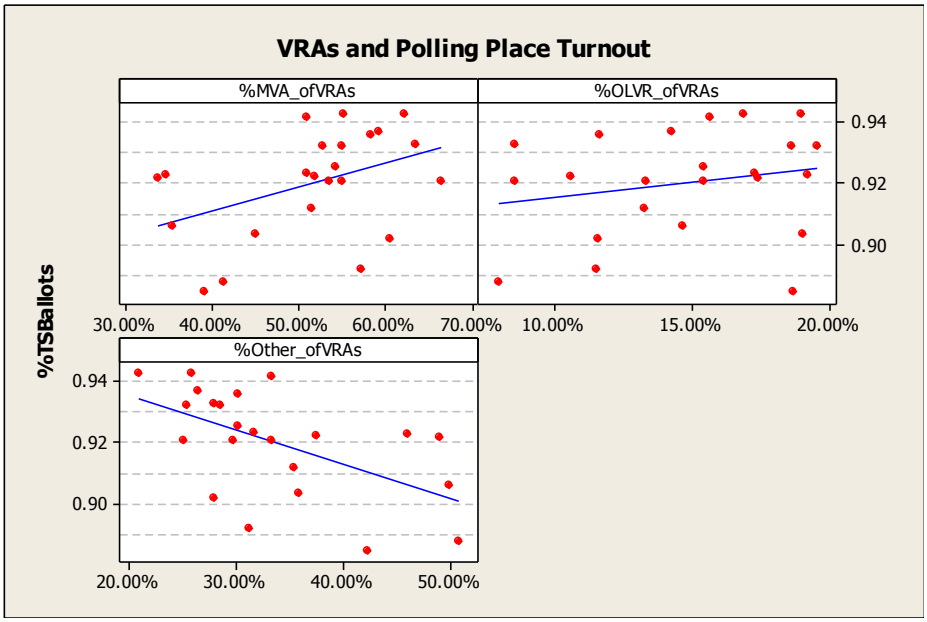


Figure 62 - Scatterplot: Polling Place Turnout by Registration Source

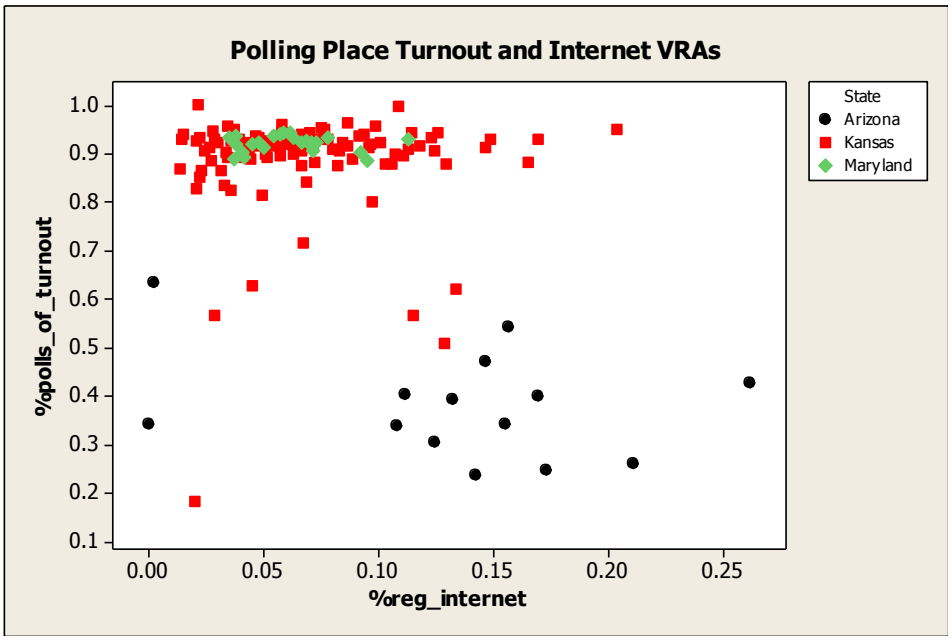


Figure 63 - Other States Polling Place Turnout and Internet VRAs

Absentee Ballot Requests and OAR

OAR and Rejected Ballots for No Application

While Federal law allows for UOCAVA voters to submit a Federal Write-In Absentee Ballot (FWAB), at the time of this writing Maryland law did not permit a FWAB ballot to be counted unless the voter had submitted a request for an absentee ballot already. One goal of the Online Absentee Request system was to allow UOCAVA voters to submit a timely absentee application so that more FWABs could be counted. However, the evaluation of this data is difficult, due to the small number of FWABs submitted. Figure 64 and a corresponding regression analysis show that no correlation can be found between the percentage of requests from OLVR and the percentage of requests rejected for lack of an application. Table 13 shows that analysis is difficult due to the abnormal distribution of FWABs throughout the state as well as the many counties with none at all.

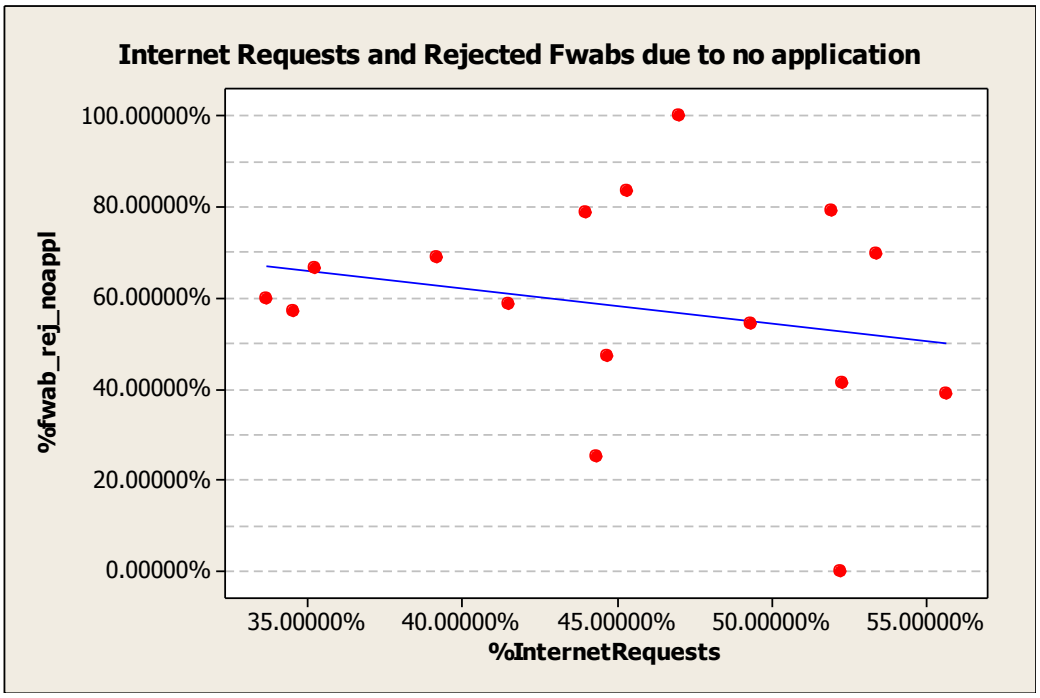


Figure 64 - Scatterplot of OLVR VRAs and Rejected FWABS for Lack of Application

Table 13- FWABs Rejected for Lack of an Application

County	total_fwab	fwab_rej_noappl
Allegany	7	4
Anne Arundel	115	80
Baltimore City	129	77
Baltimore County	126	74
Calvert	17	8
Caroline		
Carroll	19	15
Cecil		
Charles		
Dorchester		
Frederick	61	42
Garrett		
Harford	5	0
Howard	53	22
Kent		
Montgomery	519	282
Prince George's	173	137
Queen Anne's	3	3
St Mary's	18	15
Somerset		

Talbot		
Washington	8	2
Wicomico	23	9
Worcester	6	4

Online Ballot Request and UOCAVA Turnout

At a statewide level, the turnout of UOCAVA voters among those who submitted an online absentee request only was 71.38%, while the turnout among those who submitted another form of request (mail, in-person, etc.) was 76.59%. However, looking at the data on a county level changes that somewhat: Figure 65 shows turnout among Internet applications at 73.1% and all others at 76.6%. A Mann-Whitney test indicates that the difference in turnout percentages between the two categories is significant, with a p-value of .01. The tests shows a 95% confidence that turnout among UOCAVA voters who submit a request via the Internet is between 8.4 and 9.6% lower than the turnout for those submit a request via another fashion. Tests in future elections will be necessary to confirm if it was the nature of the given election or if it is an ongoing trend. It is conceivable that voters who submitted an Internet request at the very last deadline did not return a ballot because they knew it would be late.

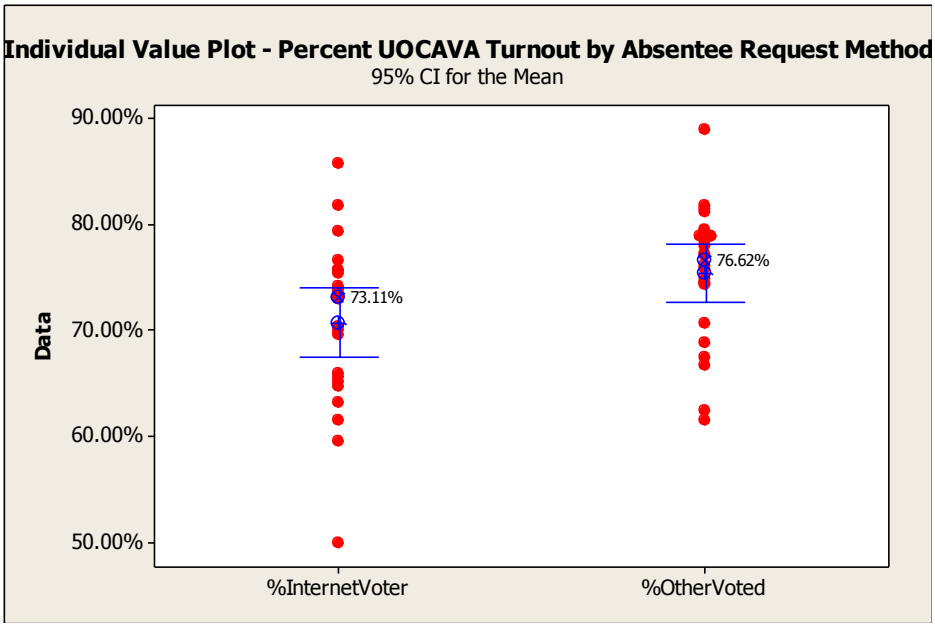


Figure 65 - Individual Value Plot: Online Absentee Request and UOCAVA Turnout

Absentee Ballots and OBD

Ballot Transit Days

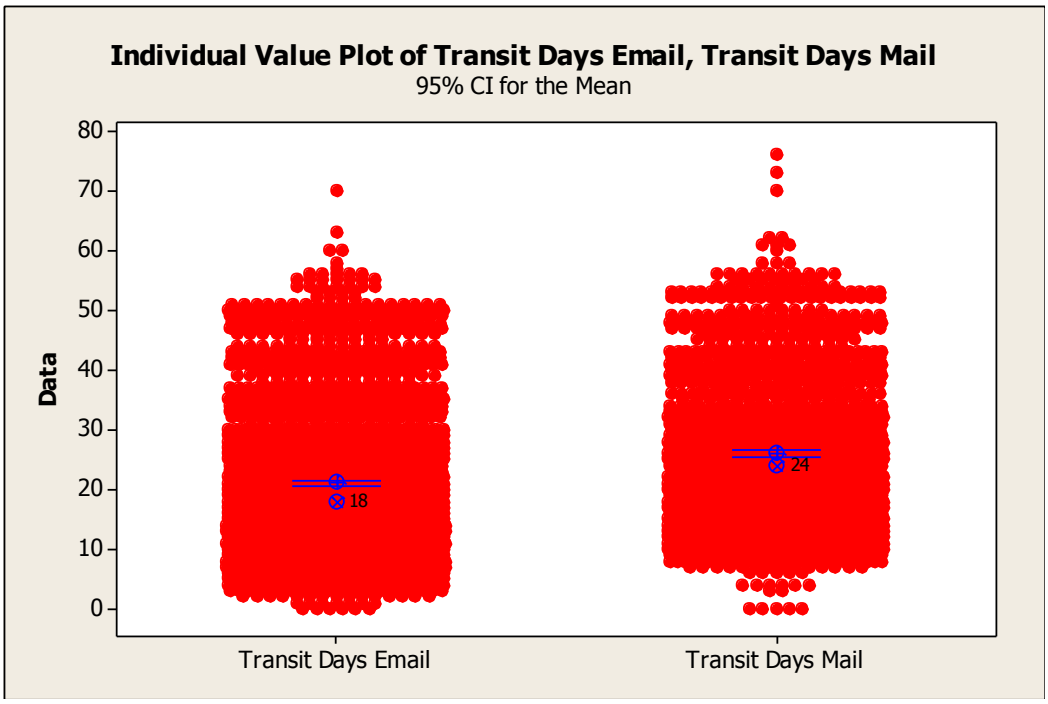


Figure 66 - Individual Value Plot Military Ballot Transit Times

Figure 66 gives a visual representation of the numbers of days ballots took in transit (from sent date to return date) for military voters. While the times look largely similar, with both email and mail having transit times as short as a day and as long as 70 days, the median value for email ballots is 18 days while the median for mailed ballots is 24 days, only 6 days improvement. While this does show that transit times for email ballots are typically shorter, the difference is not as dramatic as we had expected. Further, any ballots with a transit time of longer than 57 days were late for the election and received after canvass closed. This plot shows late ballots in both categories, based simply on the number transit days.

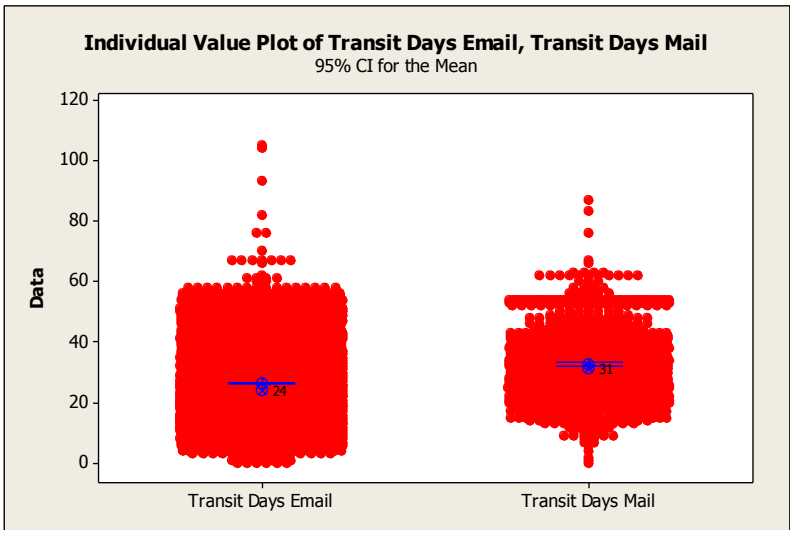


Figure 67 - Individual Value Plot of Ballot Transit Times for Civilians Temporarily Overseas

Figure 67 gives a visual representation of the numbers of days ballots took in transit (from sent date to return date) for civilians who are temporarily overseas. Like the military values, the transit times are not as different as expected; the median value for email ballots is 24 days while the median for mailed ballots is 31 days, an improvement of 7 days, and the best of all three types of UOCAVA voters.

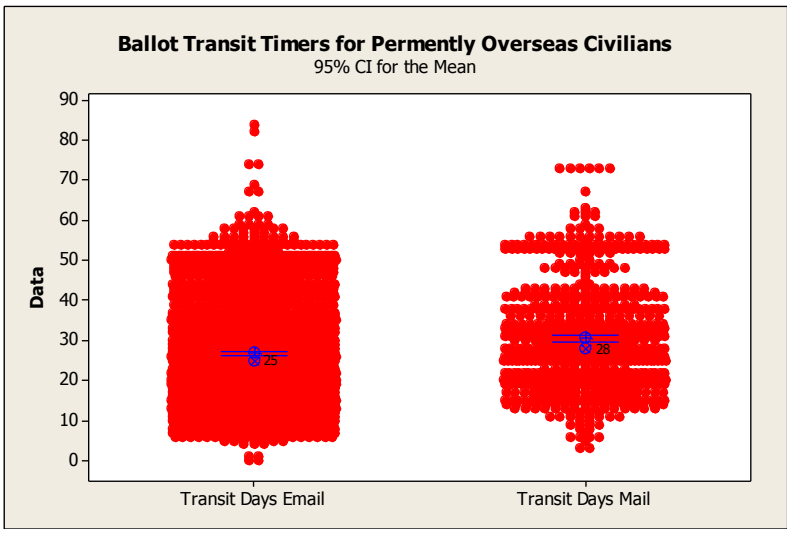


Figure 68 - Individual Value Plot of Ballot Transit Times for Civilians Permanently Overseas[38]

[38] The most striking thing is that of all UOCAVA voters, permanently overseas civilians chose email far more frequently than mail while military voters used it the least frequently, something which merits future investigation, because if the email ballots are more effective at reducing transit time and late ballots, then

Figure 68 gives a visual representation of the numbers of days ballots took in transit (from sent date to return date) for civilians who are permanently overseas. The difference between transit times in this case is minimal: the median value for email ballots is 25 days while the median for mailed ballots is 28 days.

One explanation for the long transit times for emails is human nature: people do things at the last possible moment. This may be complicated by the nature of elections and the fact that campaigning by politicians continues through Election Day. Another possibility is that people do not notice or do not receive their notification that the ballot is ready for pickup the first time it is sent. The business process in Maryland is to send out email notifications when a ballot is available for pick up on the website. The largest notification was sent 46 days before the election, in compliance with the MOVE Act, and the emails are sent 500 at a time. The largest mailing of ballots also took place in time by 45 days before the election. Ten days before the election, a reminder email was sent out to any who had not yet attempted to log in to the online system. A few days later another reminder was sent out. After every reminder, the system had a surge in logins from voters, so whether the voters received the initial email or not, they did not respond to it until later. This is the single biggest reason for the long transit times of email ballots.

Online Ballot Delivery and Late Ballots

One of the stated goals of the Online Ballot Delivery system is that it should reduce the number of late absentee ballots. The difficulty in evaluating that is two-fold: 1) the distribution of UOCAVA voters in Maryland is uneven across the counties, with Montgomery county receiving over 1/3 of all UOCAVA ballots statewide (Figure 69) and 2) Maryland rejected only 368 UOCAVA ballots statewide, 240 of them for being late. This means that in some counties no UOCAVA absentee ballots were even rejected while in others one late, rejected ballot would show as 100% of the ballots being rejected for being.

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increasing the number of voters using the system would be beneficial. However, military voters may not always be able to use an Internet based solution, depending upon where they are stationed. An Overseas Vote Foundation post-election survey showed that overseas voters in Maryland are more highly educated than the typical UOCAVA voter, which may also impact the Internet availability and interest in using online tools (2013).

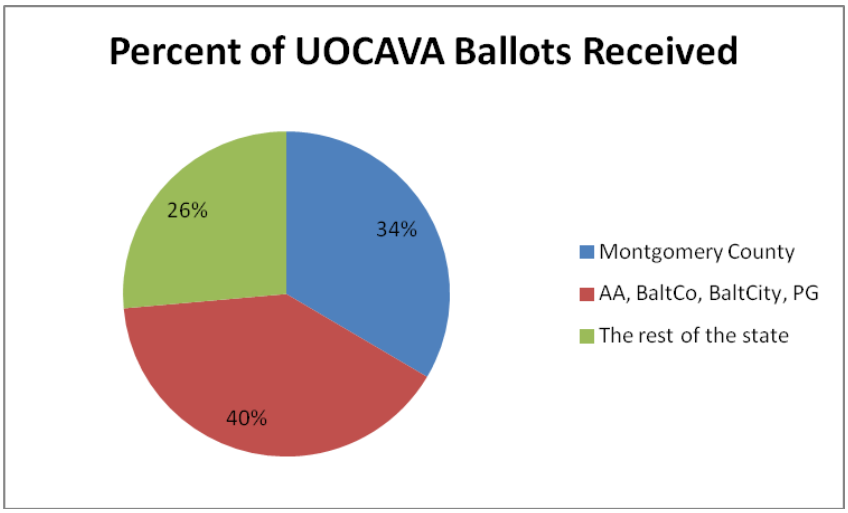

Figure 69 Percent of UOCAVA Ballots Received

The individual value plot in Figure 70 shows the difficulty quite well, with some counties rejecting ballots only because they were late (which could mean a single ballot was rejected) and other counties rejected no ballots at all. While this plot suggests, based on median values, that the mailing method is actually better and prevents late return of absentee ballots[39], there is simply too little data to make a definitive statement.

[39] SBE noted that the USPS is able to expedite absentee ballots returned in the standardized envelope. Since many of the Internet absentee ballots were returned in hand-completed envelopes, the USPS would not have been able to expedite the mail thus potentially explaining some of the difference between the return times of ballots sent by mail versus those sent via the Internet.

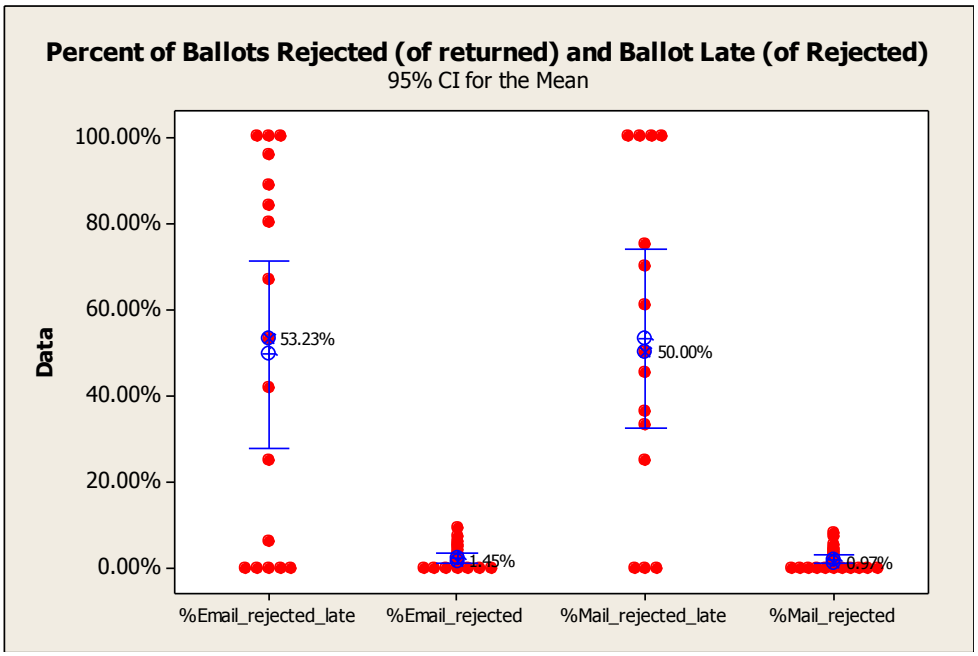

Figure 70 - Percent of Ballots Rejected and Ballot Rejected for Being Late

An alternative approach for reviewing this data is to group UOCAVA returned ballots into a normal distribution, with Montgomery county being Group 1, the other four large counties being Group 2, and the rest of the counties being Group 3. This approach, in Table 14, also shows that email ballots are rejected for being late more often than are mailed ballots.

Table 14 - Rejected and Late Absentee Ballots by Groups

Group	%EmailRejected	%MailRejected	%EmailRejectedLate	%MailRejectedLate
Montgomery County	1.86%	1.21%	53.23%	45.45%
AA, BaltCo, BaltCity, PG	4.17%	5.70%	75.97%	64.56%
The rest of the state	1.97%	1.57%	55.32%	53.33%

The prior section on ballot transit times does show that some email ballots are returned late simply based on transit times. However, since email transit times are smaller than mail transit times, the increase in ballots rejected from the email system must be impacted further by some other factor. The most likely one is that ballots continue to be sent to voters using the online delivery system as late as election day while mailed ballots would not be sent that late. Confirming this theory, Figure 72 displays the counts of the ballots which were rejected

for being late with the date the ballot was transmitted. The median day sent for late email ballots is 22 days before the election, while the median day for late mailed ballots is 37 days before the election.

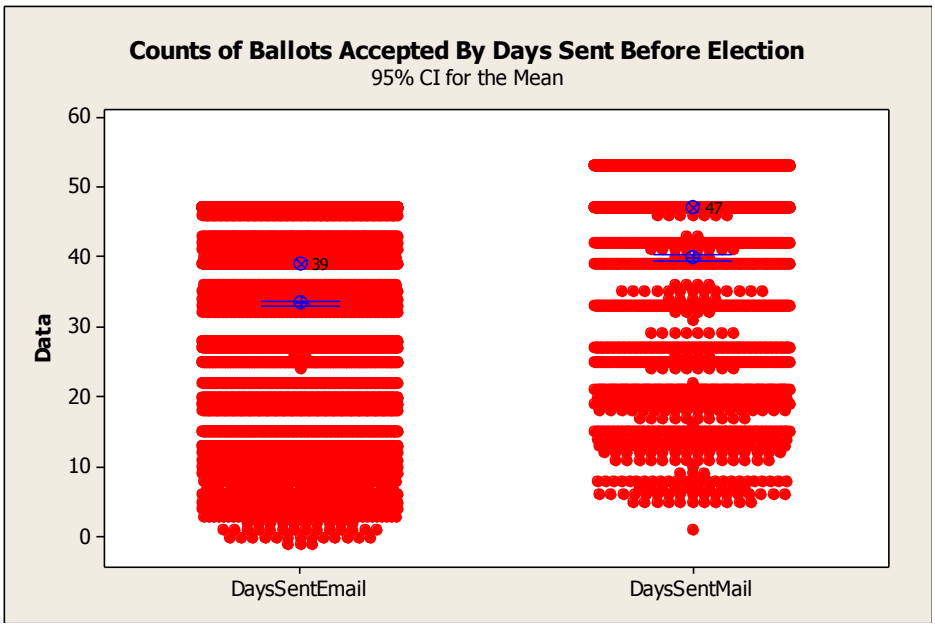

Figure 71 - Count of Accepted Ballots by Days Sent Prior to Election

Similarly, Figure 71 displays counts of the ballots which were accepted with the date the ballot was transmitted. The median day sent for accepted email ballots is 39 days before the election while the median day sent for mailed ballots is 47 days before the election. The increase in rejected email ballots does come from sending them too late for timely mail delivery, but it is also true that sending ballots via OBD reduces the number of days required to return a ballot on time.

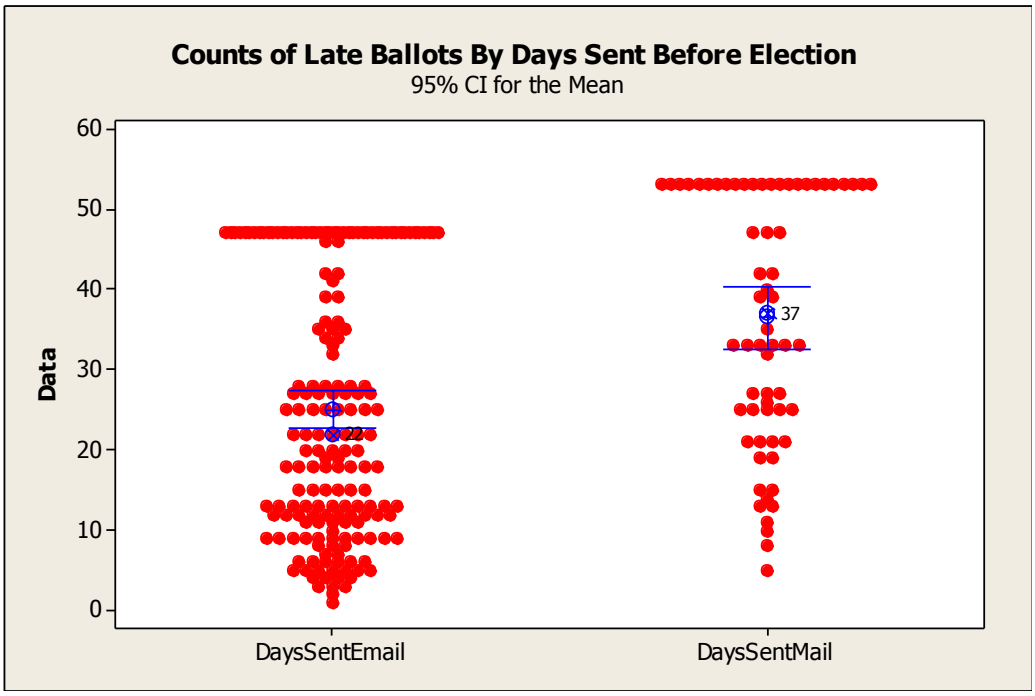

Figure 72 - Count of Late Ballots by Dates Sent Prior to Election

Turnout among UOCAVA voters is determined by the percentage of ballots that were sent which were returned, whether those ballots were accepted or rejected. At a statewide level, turnout among UOCAVA voters sent ballots via email or Internet was 74.77% and turnout among UOCAVA voters sent ballots via other methods (primarily mail, though insignificant numbers were from fax, agent, or in person), was 73.13%. However, when reviewing the percentages by county (Figure 73) the other methods show at over 75% while email/internet is around 73%. However, the outliers in both categories make the pattern unreliable. A visual review, ignoring the outliers, suggests that there is no difference between the return rate of email versus all other delivery methods. The high p-value of a Two-sample T-test confirms that even with outliers included, the return rate of email is not significantly different from the return rate of all other methods.

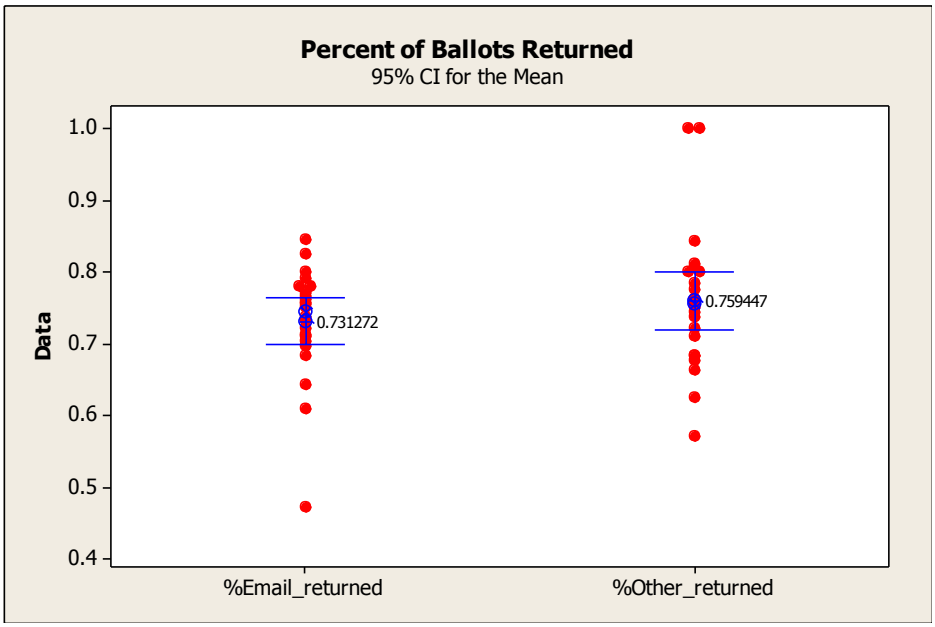

Figure 73 – Individual Value Plot: OBD and Percent of Ballots Returned

Other States

The percentages of actual UOCAVA turnout from the EAC reports for other states turned out to be inaccurate, due to discrepancies in the reporting methods. Some counties included FWABs received in the Sent ballot category, some included FWABs in the returned ballots while others did not, some listed FWABs separately on their own line while still including them in the returned ballot counts, etc. As a result, some jurisdictions showed as much as 200% UOCAVA turnout while others showed 0. In an attempt to eliminate the problem records, I looked at only those counties where the percent turnout was lower than 100%. Figure 74 displays that result, showing the percentage of ballots received in counties which had both Online Ballot Delivery and Online Absentee Request was several percentage points higher than in those jurisdictions with neither. (In the sample used there were no jurisdictions with just one of OBD and OAR).

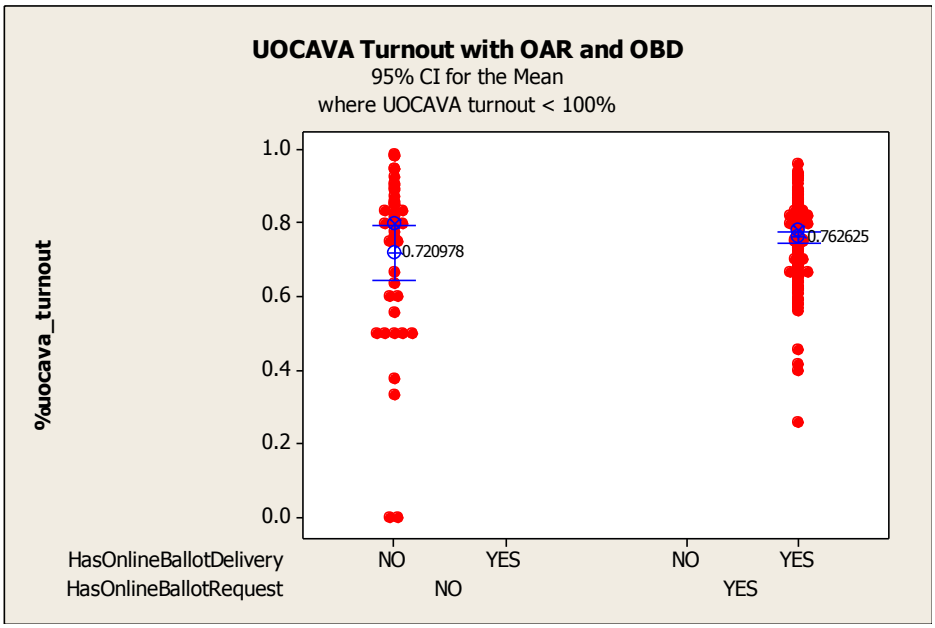

Figure 74 - Individual Value Plot: Other States and UOCAVA turnout

Figure 75 shows the percentage of UOCAVA ballots rejected as untimely in the state which does not have OBD (Florida) and the states that do. The states with OBD do show a lower percentage of absentees from UOCAVA voters rejected for being late by a small percentage – less than 2%.

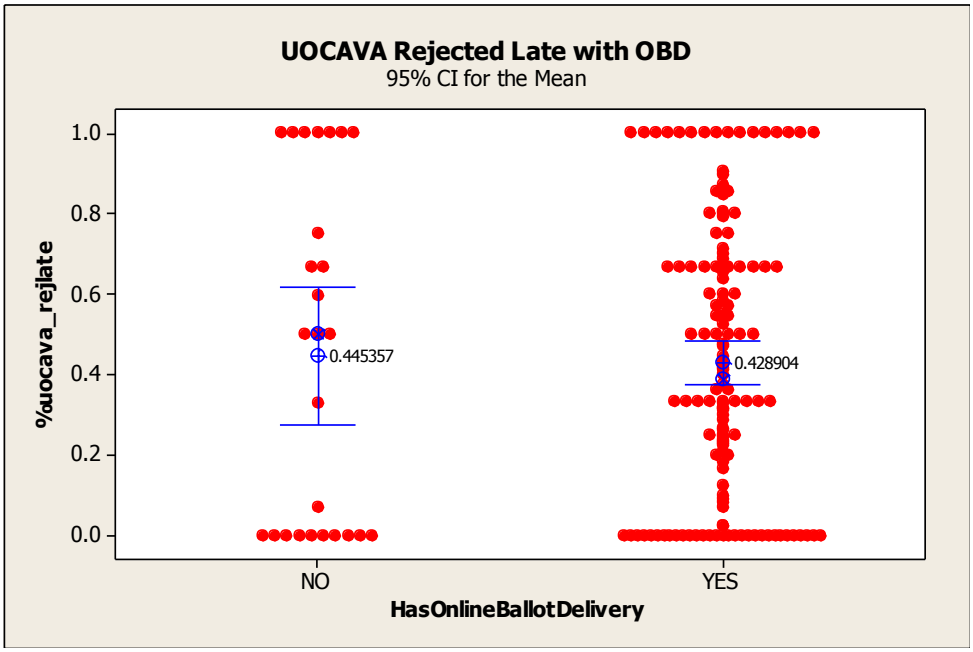

Figure 75 - Individual Value Plot: Other States UOCAVA Rejected as Untimely

CHAPTER 6

CONCLUSIONS

Hypotheses Conclusions

Gender will not significantly influence the voter's choice to use technological solutions.

The hypothesis that gender is irrelevant to the choice to use technology was proven with the caveat that more research is needed. While some slight tendency exists for males to be more likely to use OLVR when looking at the data on a county-by-county basis, the difference is statistically insignificant. EMV does not reflect a voter preference in any way, because Motor Voter presents an application to a voter in the course of a driver's license or ID transaction. However, the slight tendency visible at the statewide level for females to be less likely to use OLVR in favor of other forms of registration is apparent in certain party analyses and transcends every age group. Further research would be valuable in identifying true gender preferences and to see if anything changes over time; however, at this point the data points to an equitable representation of the genders.

Party will not significantly influence the voter's choice to use technological solutions.

The hypothesis that party would not impact the use of OLVR is disproven. Unaffiliated and third party voters show a distinct preference to use OLVR. However, the preference for third party voters is changed when considered in conjunction with gender: OLVR is no longer the first choice when looking at third party female voters. This suggests that the statement regarding gender preference for OLVR being statistically insignificant may need further research. Although some similarity between the Democrat and Female registration statistics exists, no significant finding regarding OLVR use and the major parties was discovered. Further research is needed to determine if the female demographic may be the reason for the Democratic tendency toward paper registration. Given that the paper

category counts included registrations through provisional ballots, further research is needed to determine if Females and Democrats show a higher percentage in the category due to registration issues or if they simply do have a slight, if insignificant tendency to prefer paper over technology.

Age will influence a voter's choice to use any technological solutions, with the exception of EMV which is likely to be used equally by all age groups. Specifically, technology will be used more by voters under 30 and less by voters over 65.

The significance of age with registration method was proven, with those over 65 showing an increasing disinclination to use OLVR and those under 30 being the most likely to use OLVR. The correlation between census population over 65 and the percentage of Internet VRAs in Arizona, Kansas, and Maryland did not show a strong connection, but the plots suggested a correlation. Further research in other states with more precise data is needed to confirm the data outside of Maryland. It is also possible that as the voters in Maryland become more familiar with the existence of OLVR those over 65 will become more comfortable using it, so this statistic may change over time.

Because of the complex nature of elections, the various technical projects will not significantly impact the overall percentage of voter turnout.

This hypothesis was proven, with no change in overall turnout being attributable to a given registration type. A review of the EAC data in other states also confirmed the lack of correlation.

OLVR and EMV will reduce the overall percentage of provisional ballots cast.

At this point the data suggests that this hypothesis is true for EMV, though with the caveat that with the current data the variances are too wide to make a strong statement. Not enough OLVR registrations were received to strongly impact turnout in anyway. However, it is definitely confirmed that both types of applicants are less likely to require a provisional ballot than other types of applicants. The data from the EAC report was not precise enough to answer the question in other states.

EMV will reduce the number of provisional ballots rejected due to registration-related problems.

This was not confirmed in the way the hypothesis was worded; any correlation was positive rather than negative and did not show statistical significance. However, a review of the MVA applicants who submitted a VRA shows that significantly fewer of them were rejected due to registration-related reasons than those who submitted a paper application. The percentage of rejected provisionals was also lower in states which had EMV versus those that did not.

EMV will reduce the number of provisional ballots which are "Accepted in Part".

This was disproven. Not only was there no correlation between the number of EMV applications and the accepted in part provisionals, but the percentage of provisionals from EMV applicants which were accepted in part was significantly higher than the percentage of Accepted in Part provisionals from applicants who used paper. However, this is likely attributable primarily to convenience voters and is not necessarily indicative of a registration problem. Only Maryland and Alaska of the sample states had accepted in part provisionals, so it is unknown what impact exists in other states.

OLVR will increase the number of polling place ballots cast.

This was disproven; OLVR had no impact on the number of polling place ballots cast.

OLVR will increase the percentage of provisional ballots rejected.

This was disproven. No correlation exists at all between the percentage of provisional ballots rejected and the percent of OLVR registrations. Also, applicants who submitted an OLVR VRA and voted provisionally had the smallest likelihood of having their provisional ballot rejected both in Maryland and in other states. In fact, according to the EAC data, states which had both EMV and OLVR had the lowest percentage of rejected provisional ballots.

OAR will reduce the percentage of absentee ballots rejected for lack of an absentee ballot application.

Too little data existed for an analysis of this. No correlation at all existed between the percent of FWABs rejected for lack of an application and use of the OAR system. Further, with such a small dataset, identifying a trend was not possible. Attempts to compare the 2012 General election with other elections did not yield useful information. Therefore, this study could not address this question. However, at the time of this writing FVAP is conducting a thorough study on this and other UOCAVA balloting issues as part of their follow-up with states that received the EASE grant. That study should provide more useful information.

OAR will increase the turnout of UOCAVA voters.

Surprisingly, this was disproven. In Maryland, the percentage of UOCAVA voters who submitted a ballot that had been returned to them was between 8.4 and 9.6% lower for those who had requested a ballot online versus those who had requested one in another fashion. Further research is needed to see if this will be consistent in other states or in other elections. If it is a consistent finding, research is needed to identify the causes, though I theorize that it may be related to the voters who make last minute requests and then do not have time to return the ballot.

OBD will reduce transit time of absentee ballots.

This was proven. For military voters the improvement between the median transit days for OBD delivery versus other types of delivery was 6 days, for civilians temporarily overseas the improvement was about 7 days, and for civilians permanently overseas it was about 3 days. While the improvement was not the equivalent of the amount of time it would take to mail a ballot, that may be attributable to human nature; more time means voters could delay longer in mailing the ballot.

OBD will reduce the percentage of ballots rejected for being untimely

While this was challenging to evaluate due to the limited population of late UOCAVA ballots, this was in the end disproven. A higher percentage of ballots sent via OBD were

rejected for being late when compared to ballots sent via mail. However, a review of the days prior to the election ballots were sent mailed ballots were sent showed that OBD ballots continued to be sent out closer to the election than mailed ballots were and that mailed ballots had to be sent sooner in order to be returned on time for the election. So while more OBD ballots were rejected for being late, without OBD ballots more ballots would have been unable to be mailed and returned in timely.

OBD will reduce the percentage of ballots never returned.

This was disproven in Maryland. No significant difference exists between the percent of ballots returned which had been sent via OBD versus other methods. An attempt to review the data in other states revealed data anomalies that prevented an accurate analysis; however, an overall high return rate existence existed in the jurisdictions which had OBD. More research is needed to see if this is due to unrelated variables, such as the demographic of UOCAVA voters in the jurisdictions which have OBD, or if it was a result of OBD and Maryland is simply different. Hopefully, the study currently being performed by FVAP will provide additional information on this topic.

Overall Conclusions

OLVR, EMV, and other registration sources have no impact on voter turnout. No one variable or combination of variables available to this study have a tight correlation with turnout, although Median Income, Poverty level, and High School education all have some moderate connection to turnout percentage. The similarity of those regression lines to that of the percentage of OLVR applications may indicate nothing more than that those who have the money and education to use online tools are the ones using them. However, uncovering the reason for OLVR's correlation with turnout is not as important to local boards as determining the reliability and tightness of the correlation. Further observation may provide a way for the local election boards to use the percent of OLVR applications in the months leading up to an

election for estimating turnout and making appropriate administrative preparations.[40] For example, further study of OLVR applications, particularly on a week by week or month by month basis could provide clear trends for turnout estimation. However, study over the course of several elections is necessary, because with the newness of OLVR in Maryland, it is possible that it was a better predictor of motivated voters during this election than it will be in the future.

Overall, OLVR and EMV appear to be effective at reaching all demographics of voters, although unaffiliated voters are more likely to use OLVR and those over 65 are less likely to. Although OLVR and EMV do not have any impact on overall turnout, they appear to be more effective than other methods at registering voters successfully so that they are able to have their votes counted. Further, if a problem were to exist with a record, locating it with the date stamp would be possible because the applications are stored in the database, while this capability would not be possible for unprocessed paper applications. Therefore, any process problems that resulted in a provisional ballot could be more easily corrected, allowing the ballot to count, with EMV and OLVR. Continued improvements to these systems should bring further positive impacts to the registration of voters and provisional ballots. Future observations will be useful in determining how many voters are choosing to vote provisionally for convenience versus how many are registered at the wrong address in order to see the full effectiveness of the OLVR and EMV systems and also for determine what continued areas of improvement can be made to EMV and OLVR.

Online Absentee Request use was surprisingly linked to a decrease in UOCAVA turnout; however, the reasons for this require more research. It is possible that this finding would not exist in every jurisdiction or every election. Further research is required.

Online Ballot Delivery was successful in reducing transit time and thus ballots could be sent later and still returned on time. The increase in the percent of late ballots is not a sign of a problem with this approach because ballots were sent for later in the election cycle via OBD than they were via mail.

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[40] Local election boards try to estimate turnout in order to determine what resources each polling place needs; for example, the number of voting units, the number of pollbooks and election judges, the number of provisional ballots, are all decided months in advance of the election based on internal turnout estimates. OLVR VRAs may be a useful future tool for enhancing current turnout estimates.

However, transit time was not as dramatically improved as expected. More internal review of processes, technology, and voter behavior is necessary to determine how to improve this area. For example, if the voters are receiving the initial email, perhaps a reminder earlier during the 45 day period would be appropriate. If the voters are not receiving that initial email, perhaps it is due to the size of the notification being sent and limitations set by email servers and breaking the email into smaller batches would be appropriate.

The Federal Voting Assistance Program, which provided the EASE grant used by Maryland and other states for the funding of Internet ballot delivery systems, is doing a study with Professor Michael McDonald at George Mason University on how effective Online Voter Registration and Online Ballot Delivery are at improving the registration and voting process for UOCAVA voters. The findings of that study will help Maryland better interpret the results found here and further improve processes for UOCAVA voters.

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APPENDICES

APPENDIX A -MARYLAND BALLOT TRANSIT DAYS

Transit Days	Email military	Email Tempciv	Email permciv	Email cfpca	Mail military	Mail tempciv	Mail permciv	Mail Cfpca
0	6	3	2	3	5	1	0	0
1	7	7	2	0	0	1	0	0
2	15	5	0	1	0	1	0	0
3	25	13	0	2	2	0	2	0
4	41	29	3	0	6	1	0	0
5	60	31	7	0	0	0	1	0
6	74	57	21	1	5	1	4	0
7	89	92	42	1	14	2	1	0
8	87	103	40	2	29	2	2	0
9	67	65	25	1	32	5	4	1
10	62	88	40	1	50	3	2	1
11	104	117	61	2	57	2	8	0
12	79	155	62	1	50	5	4	0
13	112	234	169	1	63	7	15	3
14	82	113	51	0	66	10	17	3
15	69	139	87	1	43	21	26	1
16	55	122	65	2	27	15	11	0
17	37	78	40	3	36	20	19	2
18	48	125	57	0	46	11	11	1
19	55	174	104	2	32	16	29	0
20	44	151	90	1	43	50	37	1
21	50	112	46	2	37	35	21	2
22	53	188	92	1	45	37	34	1
23	28	118	65	2	17	18	9	0
24	26	86	29	0	24	18	5	2
25	58	104	62	1	44	58	43	2
26	68	200	130	1	58	39	34	1
27	40	100	59	0	24	29	16	1
28	46	86	51	1	40	30	28	4
29	38	113	72	4	23	22	10	0
30	35	65	38	0	18	28	15	0

Transit Days	Email military	Email Tempciv	Email permciv	Email cfpca	Mail military	Mail tempciv	Mail permciv	Mail Cfpca
31	14	55	22	0	33	23	29	3
32	22	97	40	2	48	29	19	0
33	25	86	63	1	25	34	26	1
34	28	83	26	1	23	43	21	2
35	42	136	102	0	15	23	8	1
36	19	68	35	1	22	20	16	1
37	24	64	39	0	12	7	2	0
38	12	21	6	0	21	41	26	0
39	16	51	29	0	23	24	11	2
40	13	40	9	0	21	13	5	0
41	24	127	70	1	24	27	21	0
42	21	59	29	2	19	25	15	3
43	20	56	23	0	27	21	13	1
44	16	39	36	1	11	12	2	0
45	8	20	9	0	13	10	1	1
46	16	44	21	4	12	13	1	0
47	32	67	33	2	18	8	5	0
48	20	38	33	3	25	13	9	0
49	23	75	28	1	18	8	6	1
50	40	139	89	0	8	6	2	1
51	18	95	50	1	1	1	1	0
52	4	11	6	0	22	17	6	0
53	4	9	5	0	22	42	27	1
54	7	69	25	4	10	42	26	0
55	7	25	9	0	7	3	1	0
56	5	23	9	0	10	5	12	0
57	1	6	3	0	0	2	0	0
58	1	16	7	0	3	4	4	0
59	0	1	4	0	0	1	1	0
60	2	2	0	0	1	3	0	0
61	0	4	4	0	3	0	3	0
62	0	1	1	0	2	11	3	0
63	1	0	0	0	0	4	1	0
64					0	0	0	0
65								
66	0	1	0	0	0	1	0	0
67	0	7	2	0	0	1	1	0
68								
69	0	0	1	0				

Transit Days	Email military	Email Tempciv	Email permciv	Email cfpca	Mail military	Mail tempciv	Mail permciv	Mail Cfpca
70	1	1	0	0	1	0	0	0
71								
72								
73					1	0	6	0
74	0	0	2	0				
75								
76	0	2	0	0	1	1	0	0
77								
78					0	0	0	0
79								
80								
81								
82	0	1	1	0				
83					0	1	0	0
84	0	0	1	0				
85								
86								
87					0	1	0	0
88								
89					0	0	0	0
90								
91								
92								
93	0	1	0	0				
94								
95								
96								
97								
98								
99								
100								
101								
102								
103								
104	0	1	0	0				
105	0	1	0	0				

APPENDIX B -MARYLAND BALLOTS SENT AND RETURNED BY ISSUE METHOD

LBE	Issue Method	Sent	Returned
Allegany	Email	48	36
Allegany	In Person	1	1
Allegany	Mailed	36	27
Anne Arundel	Email	1320	1017
Anne Arundel	Faxed	1	1
Anne Arundel	In Person	1	1
Anne Arundel	Mailed	621	462
Baltimore City	Email	989	725
Baltimore City	Faxed	2	1
Baltimore City	In Person	2	2
Baltimore City	Mailed	554	379
Baltimore County	Email	1202	911
Baltimore County	In Person	6	6
Baltimore County	Mailed	389	275
Calvert	Email	152	112
Calvert	In Person	2	2
Calvert	Mailed	52	37
Caroline	Email	19	13
Caroline	Mailed	25	20
Carroll	Email	220	176
Carroll	In Person	2	2
Carroll	Mailed	98	73
Cecil	Email	128	91
Cecil	Mailed	38	28
Charles	Email	303	222
Charles	Mailed	152	95
Dorchester	Email	36	17
Dorchester	Mailed	21	16
Frederick	Email	465	357
Frederick	Mailed	180	137
Garrett	Email	33	23
Garrett	Mailed	19	16
Harford	Email	315	222

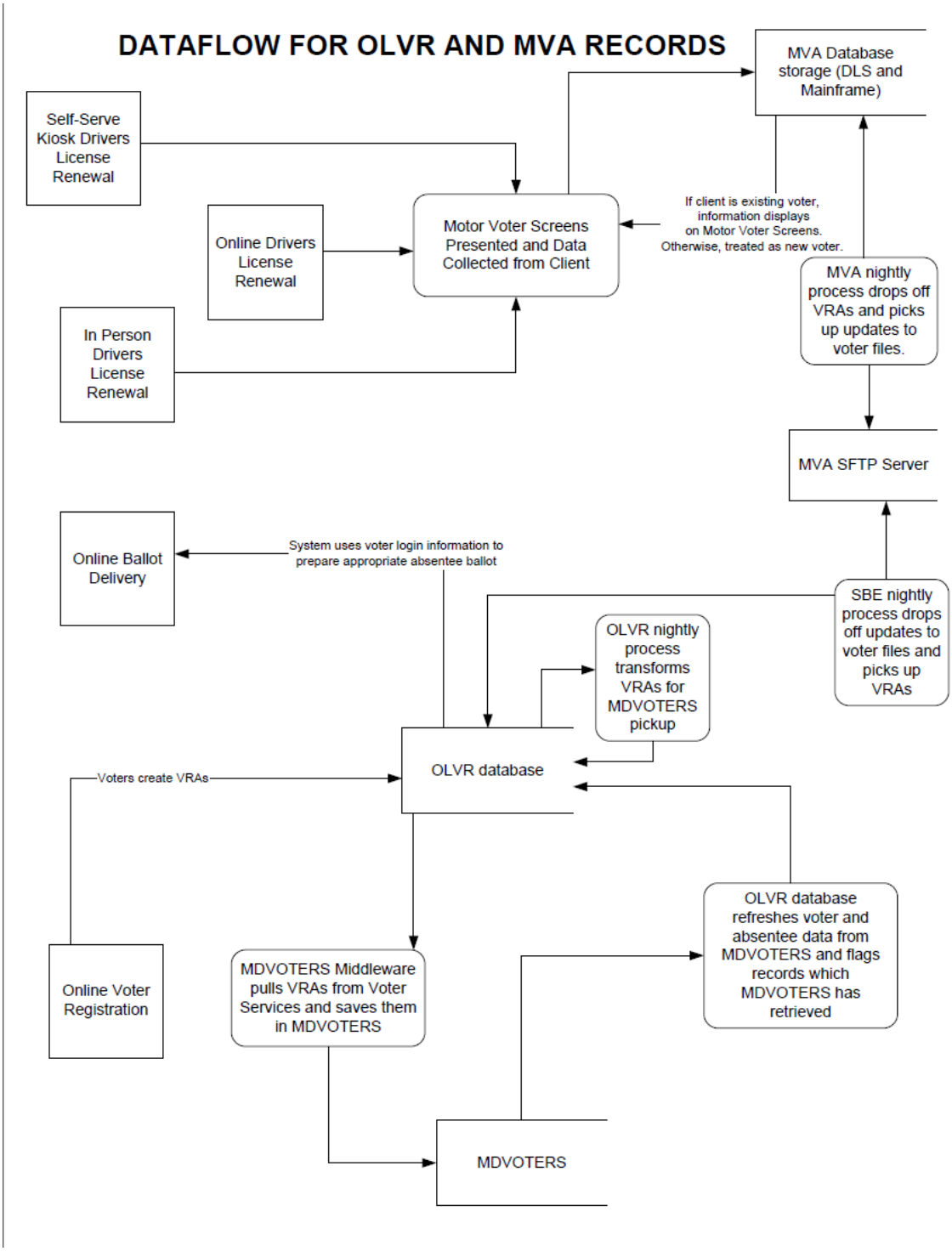
Harford	Mailed	173	99
Howard	Email	868	662
Howard	In Person	2	2
Howard	Mailed	238	184
Kent	Email	32	25
Kent	Mailed	5	5
Montgomery	Email	4404	3332
Montgomery	Faxed	2	1
Montgomery	In Person	2	2
Montgomery	Mailed	1153	906
Prince George's	Email	1455	1038
Prince George's	Faxed	1	0
Prince George's	In Person	2	2
Prince George's	Mailed	397	271
Queen Anne's	Email	72	57
Queen Anne's	Mailed	26	21
Saint Mary's	Email	179	115
Saint Mary's	Mailed	95	63
Somerset	Email	18	13
Somerset	Mailed	1	1
Talbot	Email	52	44
Talbot	Mailed	30	24
Washington	Email	128	100
Washington	Mailed	65	49
Wicomico	Email	95	58
Wicomico	Mailed	48	39
Worcester	Email	57	47
Worcester	Mailed	31	21

APPENDIX C -BALLOTS RETURNED BY METHOD SENT WITH DAYS PRIOR TO ELECTION BALLOTS WERE SENT

Days Prior To Election Sent	Email Accepted	Email Rejected	Email Rejected Late	Mailed Accepted	Mailed Rejected	Mailed Rejected Late
0	13	0	0	0	0	0
1	14	1	1	1	0	0
2	10	1	1	0	0	0
3	41	3	3	0	0	0
4	82	4	4	0	0	0
5	148	8	7	11	1	1
6	147	7	6	17	0	0
7	17	2	2	10	0	0
8	56	3	3	25	2	1
9	150	13	11	3	0	0
10	93	1	1	1	1	1
11	183	6	5	14	1	1
12	147	10	10	16	0	0
13	253	13	11	22	2	2
14	0	0	0	23	1	1
15	295	9	6	83	2	2
16	0	0	0	1	0	0
17	0	0	0	10	0	0
18	145	11	8	18	0	0
19	265	6	2	91	5	2
20	275	7	5	30	1	0
21	0	0	0	104	7	4
22	221	9	7	1	0	0
24	1	0	0	8	0	0
25	499	17	8	119	8	5
26	2	0	0	4	1	1
27	298	10	7	207	7	3
28	383	14	6	0	0	0
29	0	0	0	8	0	0
31	0	0	0	1	0	0
32	97	3	1	4	1	1

Days Prior To Election Sent	Email Accepted	Email Rejected	Email Rejected Late	Mailed Accepted	Mailed Rejected	Mailed Rejected Late
33	220	3	1	238	10	6
34	176	5	2	5	0	0
35	135	6	3	13	1	1
36	68	2	2	4	0	0
39	360	4	2	136	2	2
40	62	0	0	4	1	1
41	110	1	1	8	0	0
42	149	5	2	165	5	2
43	132	2	0	2	0	0
46	151	3	2	7	1	0
47	3748	74	46	814	7	3
48	0	0	0	0	0	0
49	0	0	0	0	0	0
53	0	0	0	913	38	24

APPENDIX D -A DATA FLOWCHART FOR OLVR VRAS



APPENDIX E -SCREENSHOTS FOR MOTOR VOTOR

ELECTRONIC MOTOR VOTER IN MVA DRIVER LICENSE SYSTEM (DLS)

The Maryland Motor Vehicle Administration

By
Tom Surock
Motor Voter Program Manager

1

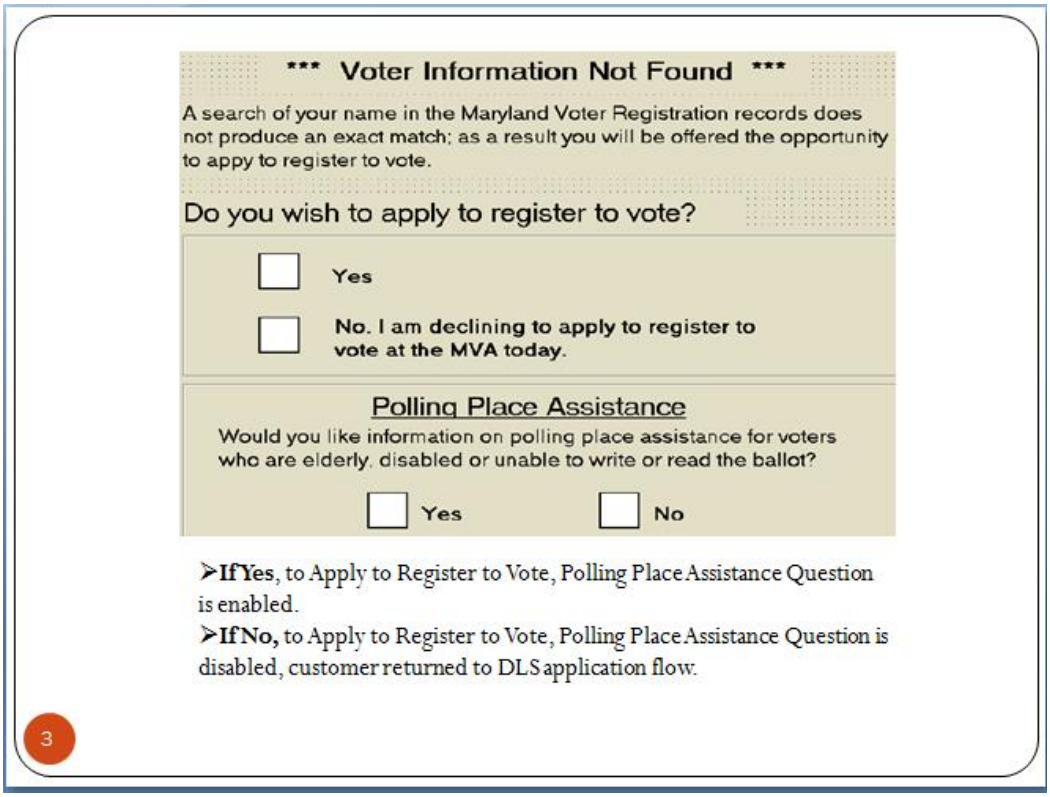
- During the DLS transaction, when the step for Motor Voter is reached, DLS sends an electronic request to the SBE's statewide voter registration database. MVA maintains a copy of the database. SBE transmits nightly updates.

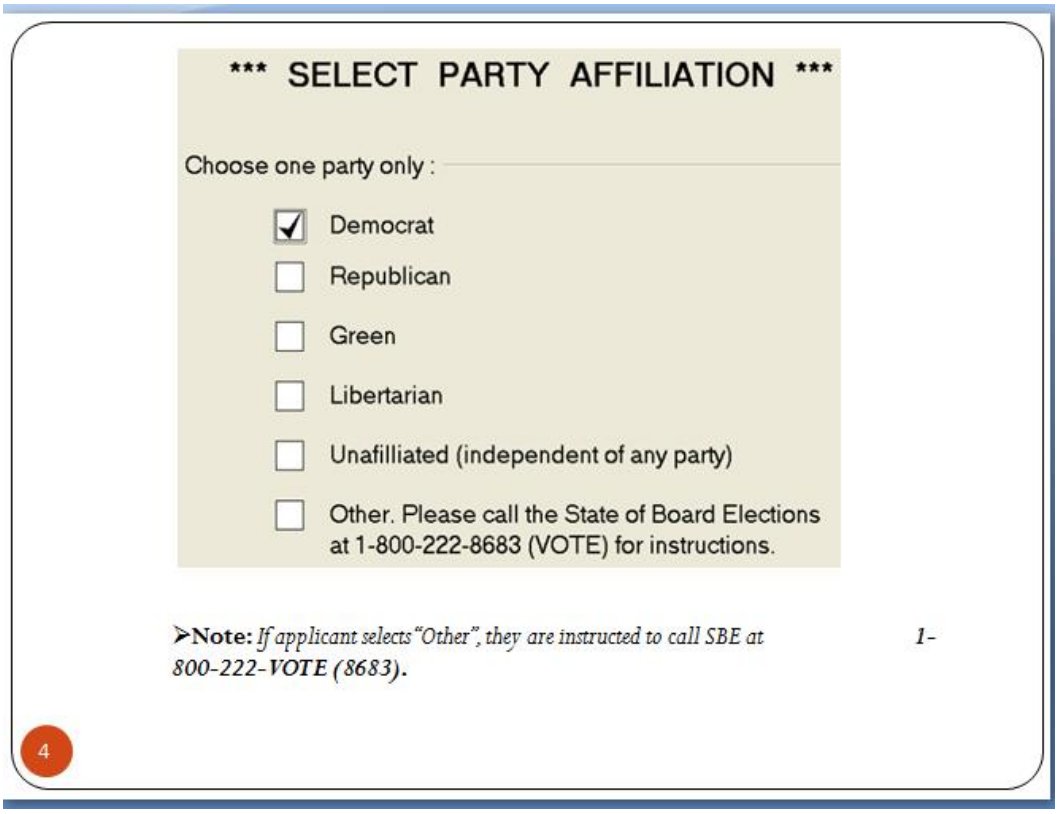
- This electronic request will only be performed for customers over the age of 16 to confirm if they are already registered to vote in MD.

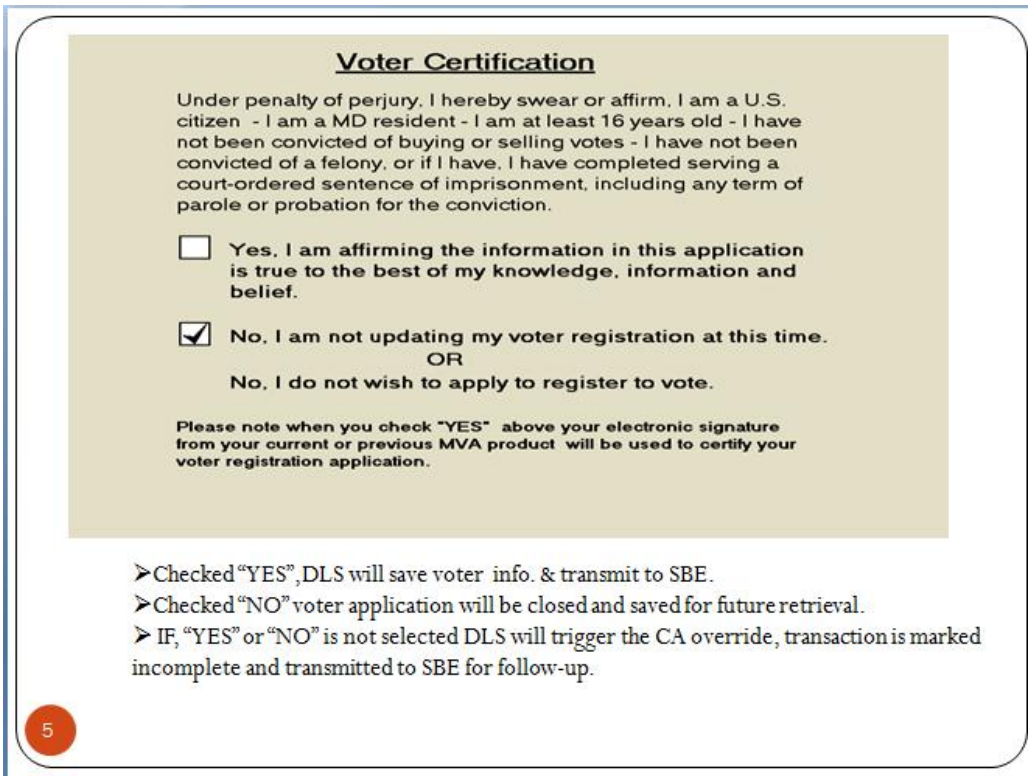
- Based on the results of the query of the voter registration database one of two scenarios or flows will be presented to customer.

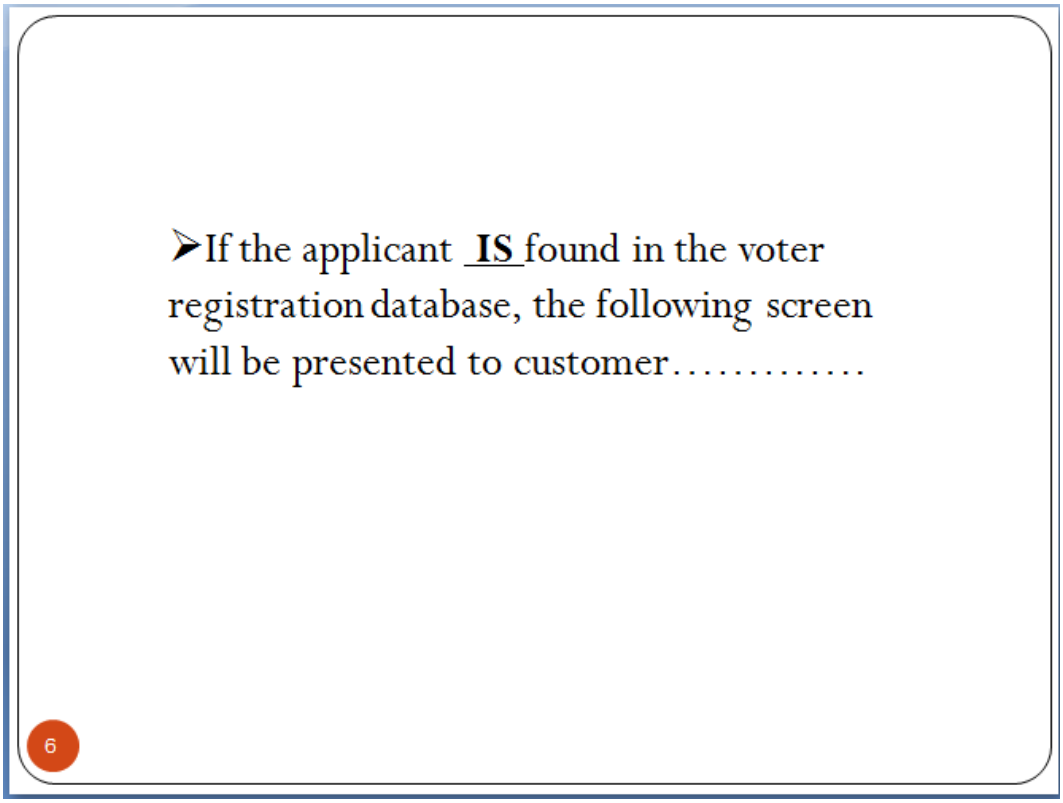
- If the applicant is **NOT** found in the voter registration database, the following screen will be presented to customer.....

2


*** Voter Information Not Found ***
A search of your name in the Maryland Voter Registration records does not produce an exact match; as a result you will be offered the opportunity to appy to register to vote.
Do you wish to apply to register to vote?
Yes
No. I am declining to apply to register to vote at the MVA today.
Polling Place Assistance
Would you like information on polling place assistance for voters who are elderly, disabled or unable to write or read the ballot?
Yes
No
➢If Yes, to Apply to Register to Vote, Polling Place Assistance Question is enabled.
➢If No, to Apply to Register to Vote, Polling Place Assistance Question is disabled, customer returned to DLS application flow.
3


*** SELECT PARTY AFFILIATION ***
Choose one party only :
Democrat
Republican
Green
Libertarian
Unafilliated (independent of any party)
Other. Please call the State of Board Elections at 1-800-222-8683 (VOTE) for instructions.
➢Note: If applicant selects "Other", they are instructed to call SBE at 1-800-222-VOTE (8683).
4


Voter Certification
Under penalty of perjury, I hereby swear or affirm, I am a U.S. citizen - I am a MD resident - I am at least 16 years old - I have not been convicted of buying or selling votes - I have not been convicted of a felony, or if I have, I have completed serving a court-ordered sentence of imprisonment, including any term of parole or probation for the conviction.
Yes, I am affirming the information in this application is true to the best of my knowledge, information and belief.
No, I am not updating my voter registration at this time.
OR
No, I do not wish to apply to register to vote.
Please note when you check "YES" above your electronic signature from your current or previous MVA product will be used to certify your voter registration application.
➢Checked "YES", DLS will save voter info. & transmit to SBE.
➢Checked "NO" voter application will be closed and saved for future retrieval.
➢ IF, "YES" or "NO" is not selected DLS will trigger the CA override, transaction is marked incomplete and transmitted to SBE for follow-up.
5

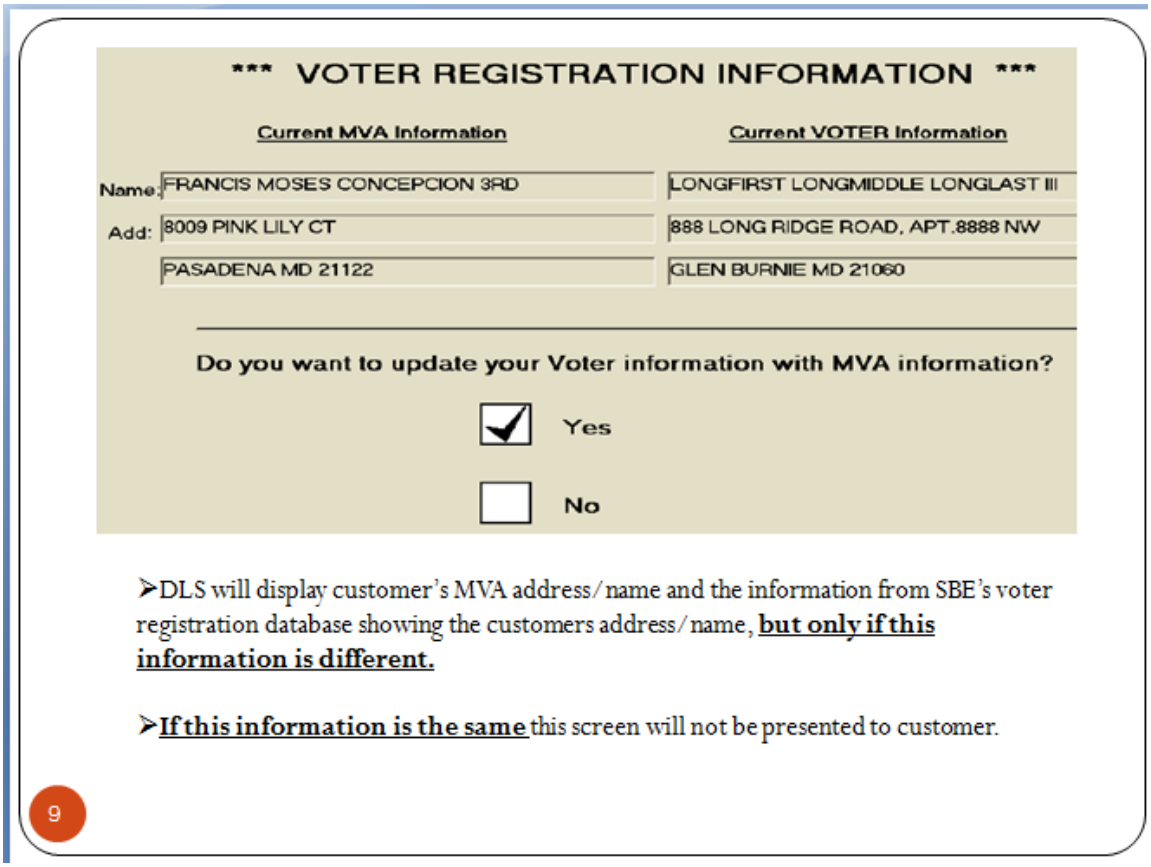

➢If the applicant IS found in the voter registration database, the following screen will be presented to customer.....
6

➢The screen will display customer's current affiliation with a political party as saved in SBE's voter registration database.
➢Both questions on screen must be answered by customer.
➢If YES, to update Party Affiliation the following screen will be displayed…….

7

➢**Note:** *If applicant selects "Other", they will be instructed to call SBE at 1-800-222-VOTE (8683).*

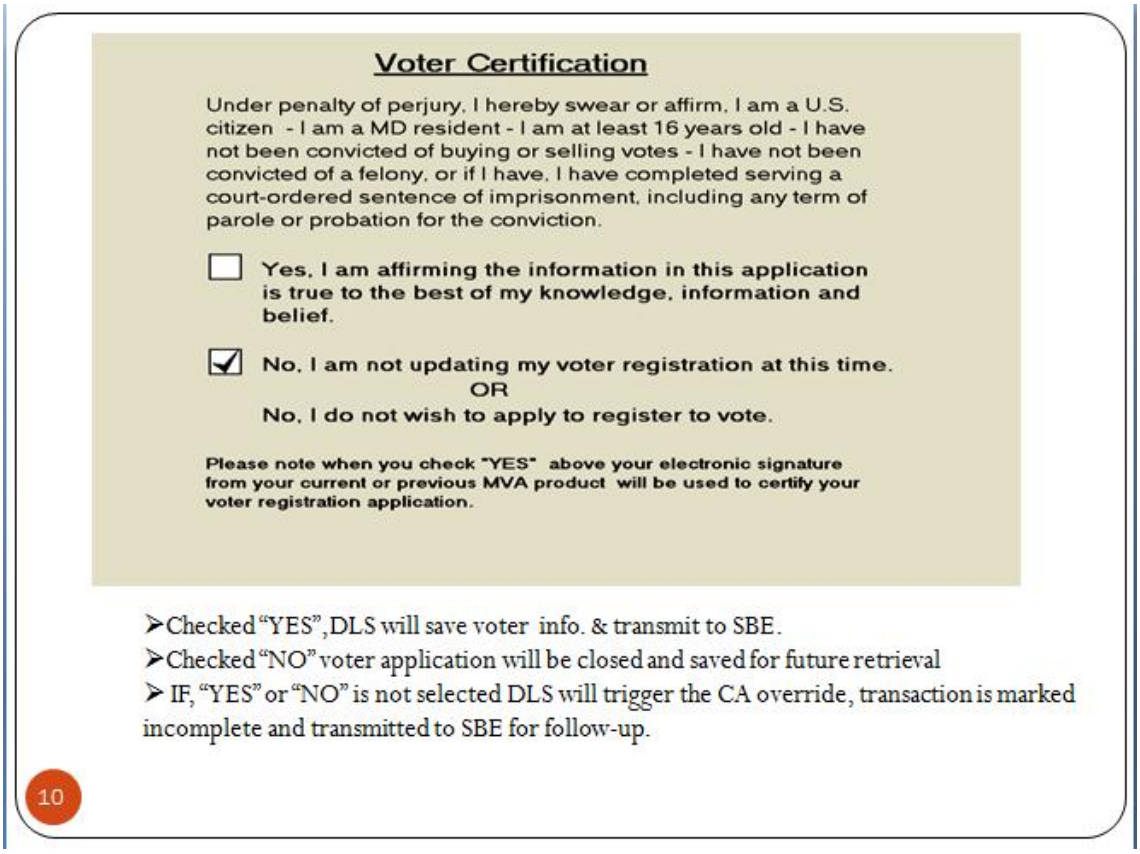
8



➢DLS will display customer's MVA address/name and the information from SBE's voter registration database showing the customers address/name, **but only if this information is different.**

➢**If this information is the same** this screen will not be presented to customer.

9

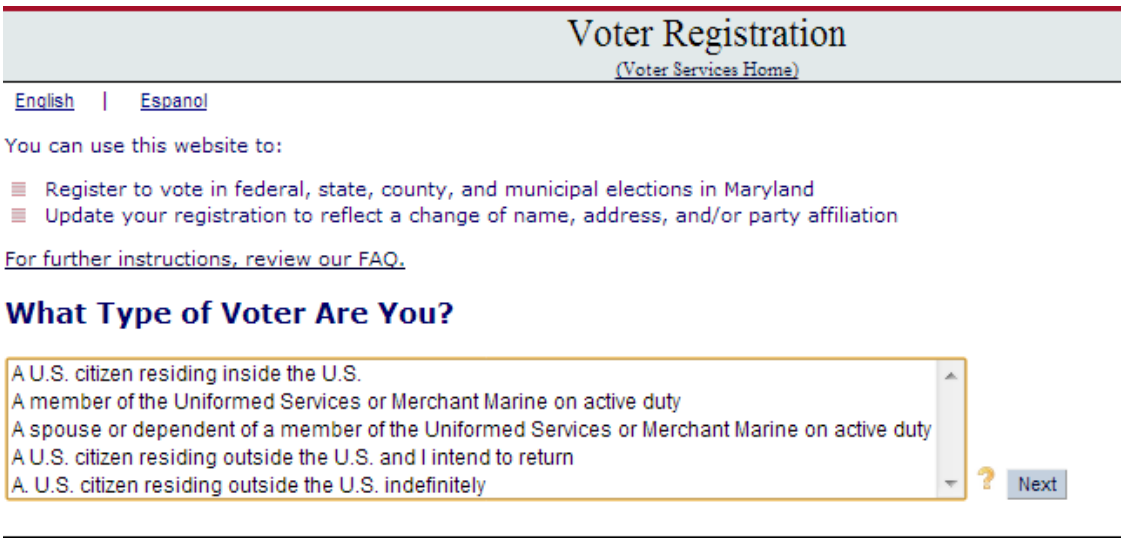


➢Checked "YES", DLS will save voter info. & transmit to SBE.
➢Checked "NO" voter application will be closed and saved for future retrieval
➢ IF, "YES" or "NO" is not selected DLS will trigger the CA override, transaction is marked incomplete and transmitted to SBE for follow-up.

10

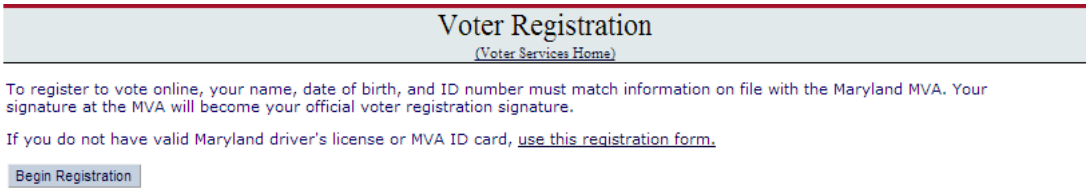
APPENDIX F -OLVR SCREENSHOTS

Page 1 – Voter Type and Identification Requirements (ALL Voters)

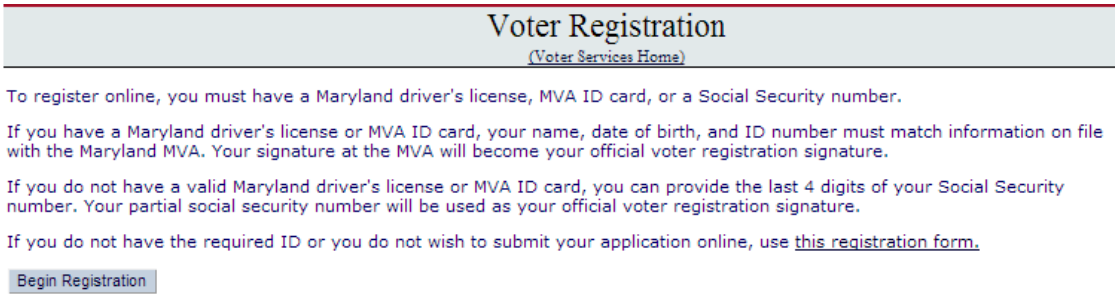


Page 2 –Identification Requirements

Domestic Voters



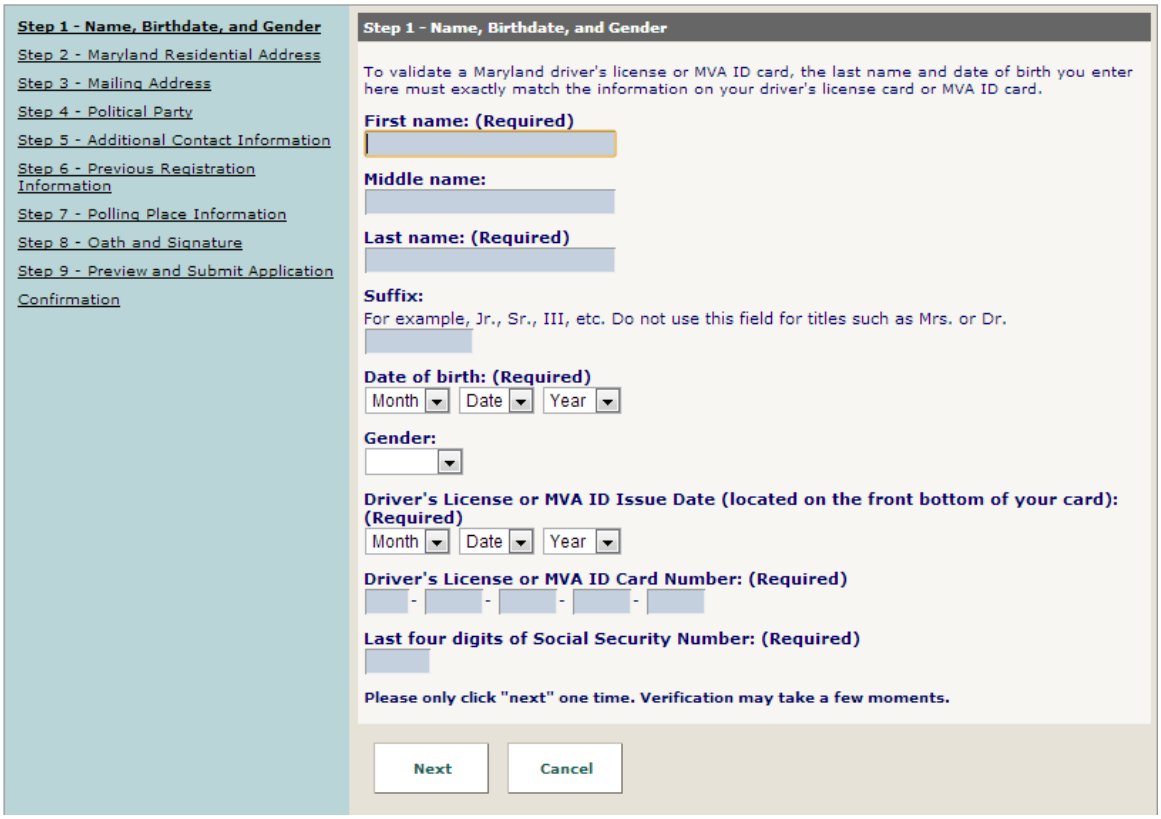
UOCAVA Voters



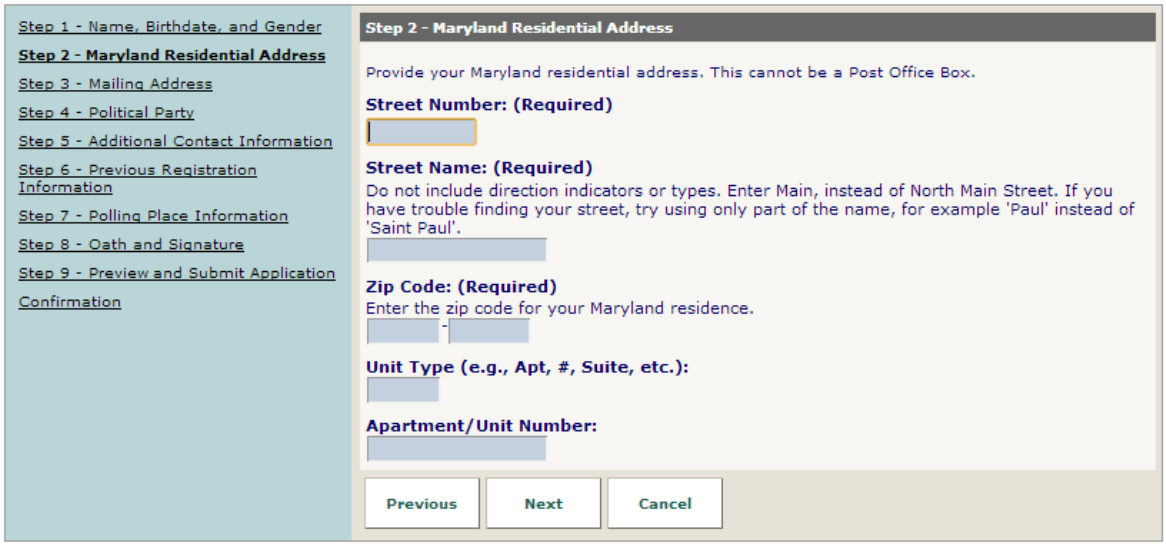
Page 3 – VRA Wizard

Domestic

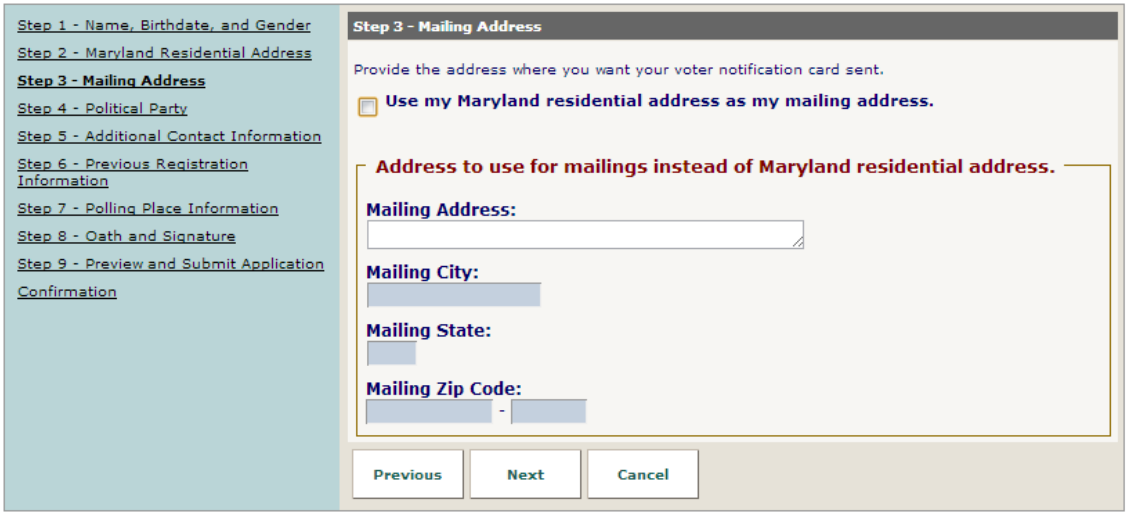
Step 1 – Voter Name



Step 2 - Residential Address

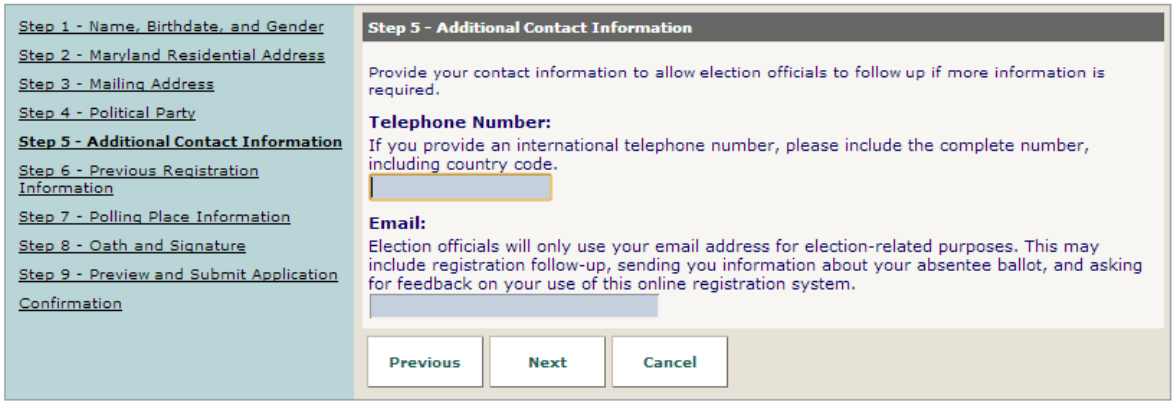


Step 3 – Mailing Address

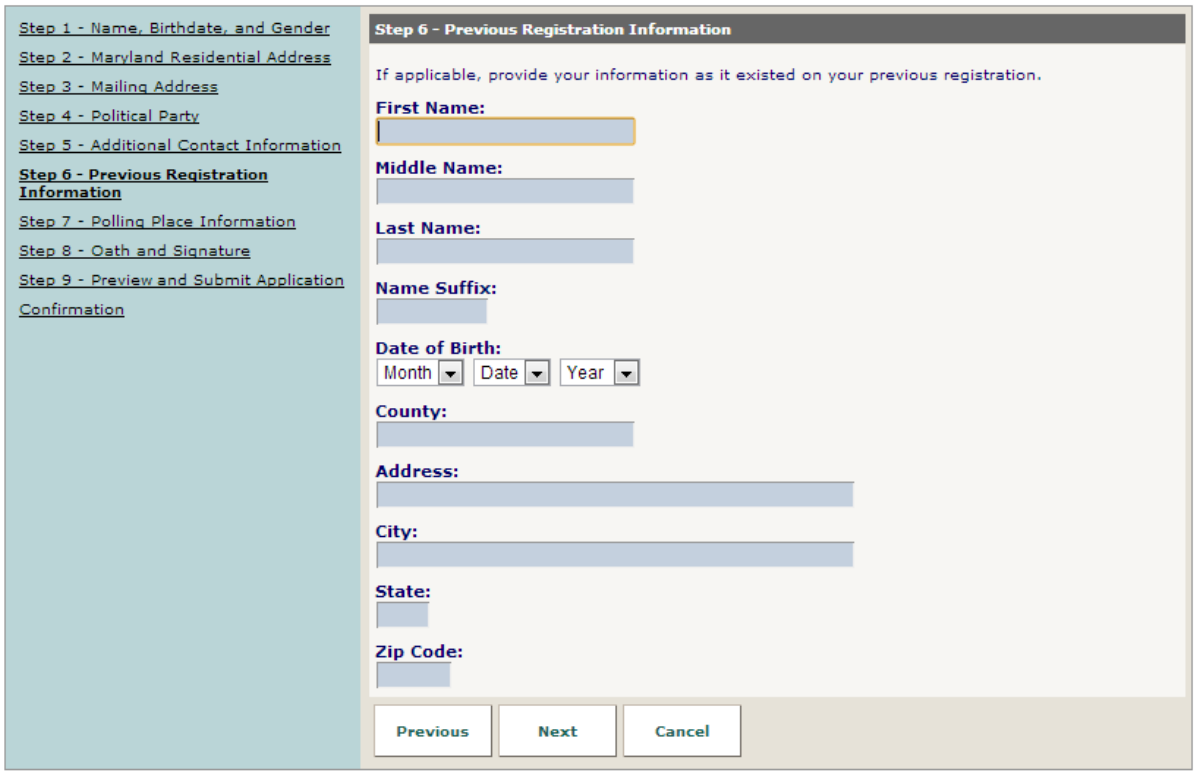


Step 4 – Political Party

Step 5 – Additional Contact Information

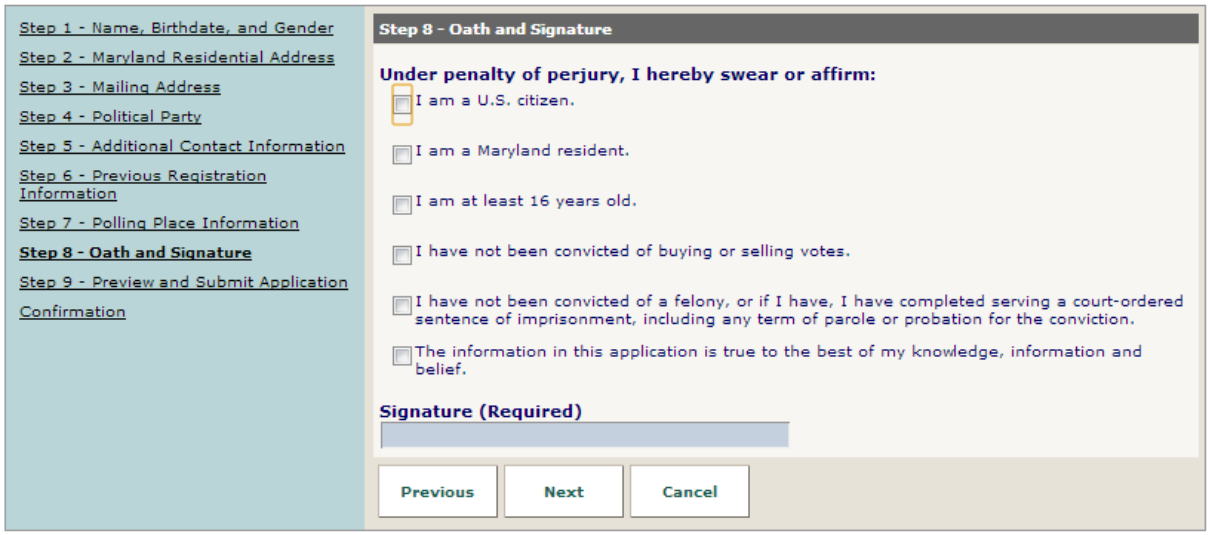


Step 6 – Previous Registration

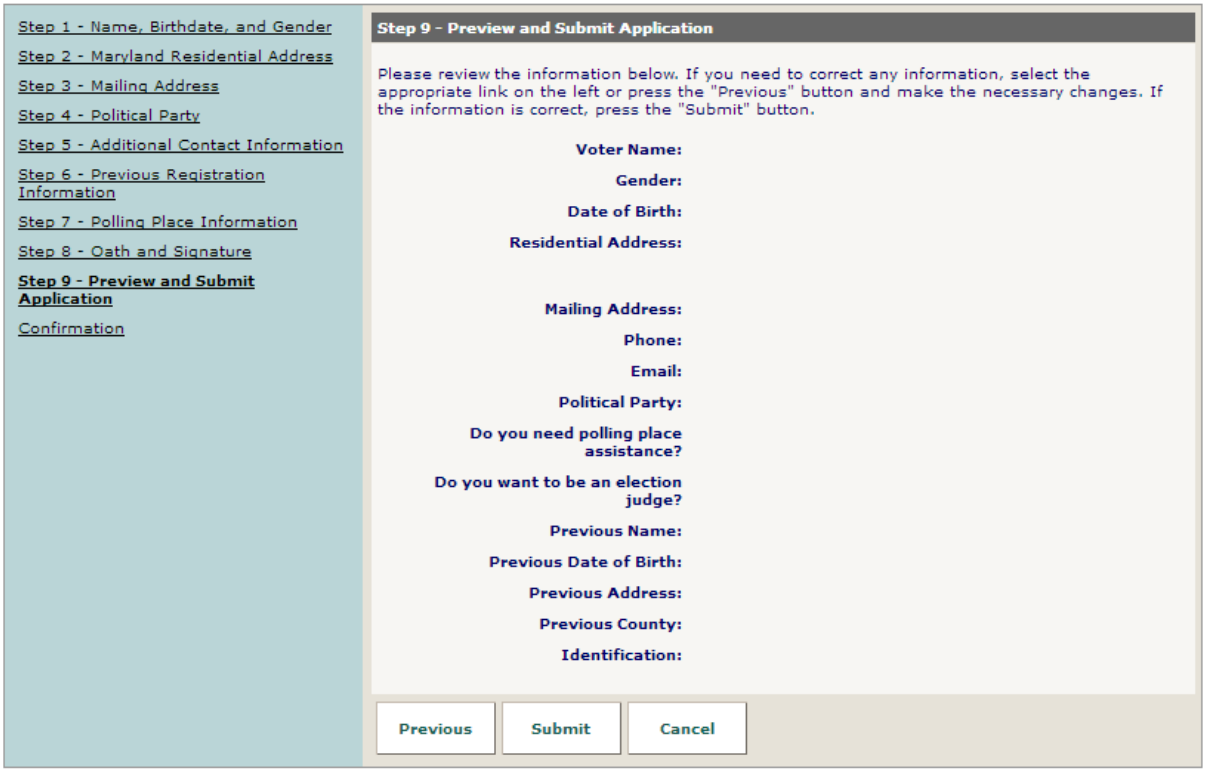


Step 7 – Polling Place Information

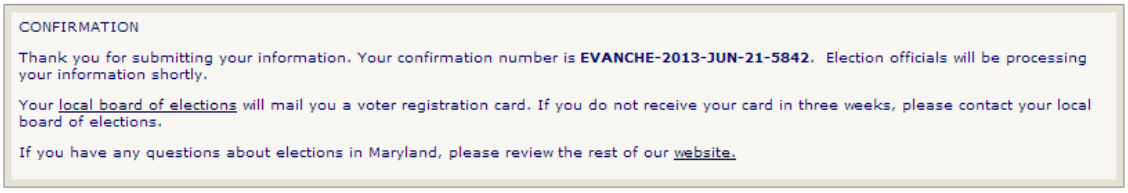
Step 8 – Oath and Signature



Step 9 – Preview and Submit Information



Confirmation



CONFIRMATION

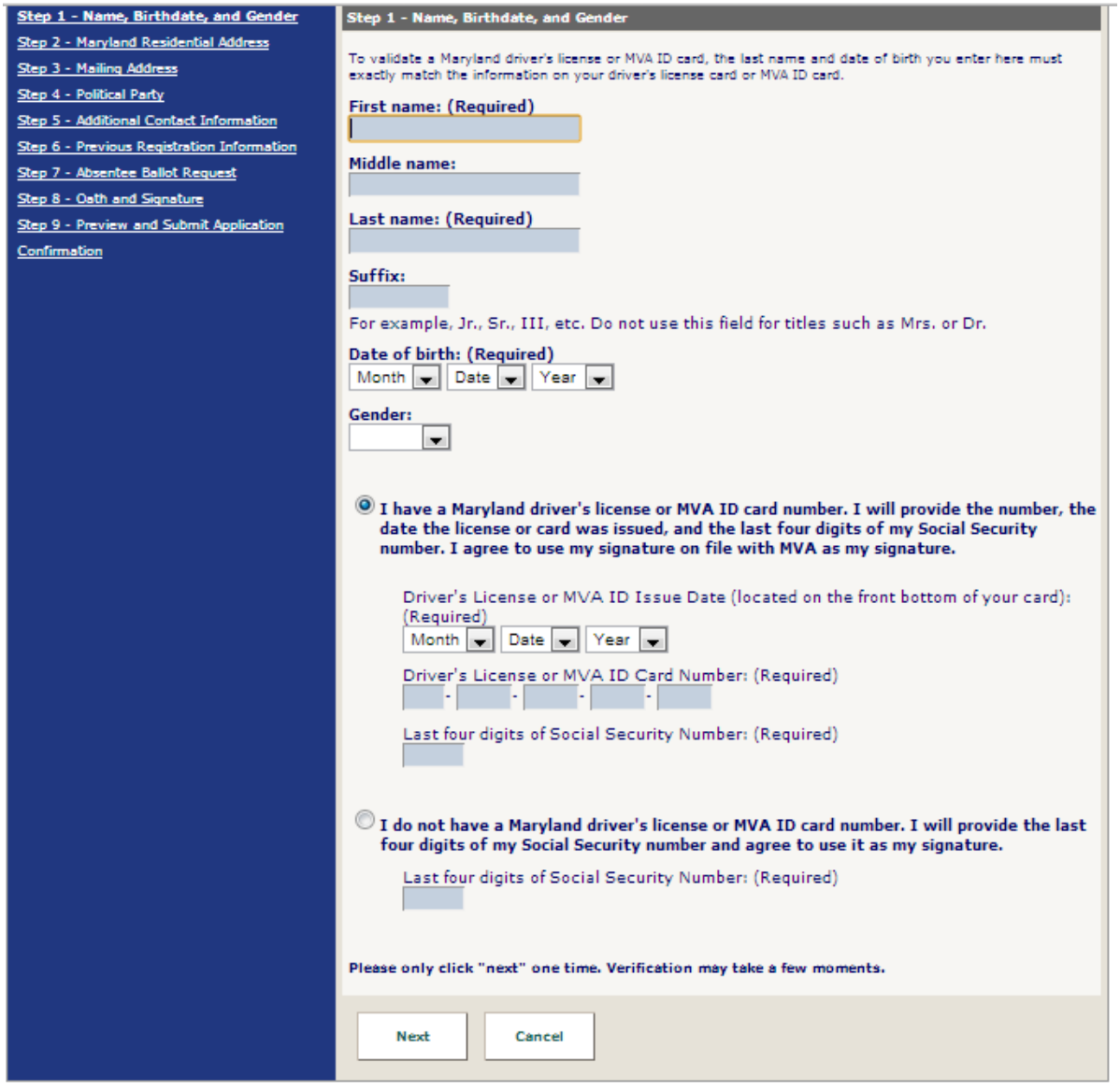
Thank you for submitting your information. Your confirmation number is **EVANCHE-2013-JUN-21-5842**. Election officials will be processing your information shortly.

Your local board of elections will mail you a voter registration card. If you do not receive your card in three weeks, please contact your local board of elections.

If you have any questions about elections in Maryland, please review the rest of our website.

UOCAVA

Step 1 – Voter Name



Step 1 - Name, Birthdate, and Gender
Step 2 - Maryland Residential Address
Step 3 - Mailing Address
Step 4 - Political Party
Step 5 - Additional Contact Information
Step 6 - Previous Registration Information
Step 7 - Absentee Ballot Request
Step 8 - Oath and Signature
Step 9 - Preview and Submit Application
Confirmation

Step 1 - Name, Birthdate, and Gender

To validate a Maryland driver's license or MVA ID card, the last name and date of birth you enter here must exactly match the information on your driver's license card or MVA ID card.

First name: (Required)

Middle name:

Last name: (Required)

Suffix:

For example, Jr., Sr., III, etc. Do not use this field for titles such as Mrs. or Dr.

Date of birth: (Required)
Month Date Year

Gender:

I have a Maryland driver's license or MVA ID card number. I will provide the number, the date the license or card was issued, and the last four digits of my Social Security number. I agree to use my signature on file with MVA as my signature.

Driver's License or MVA ID Issue Date (located on the front bottom of your card): (Required)
Month Date Year

Driver's License or MVA ID Card Number: (Required)

Last four digits of Social Security Number: (Required)

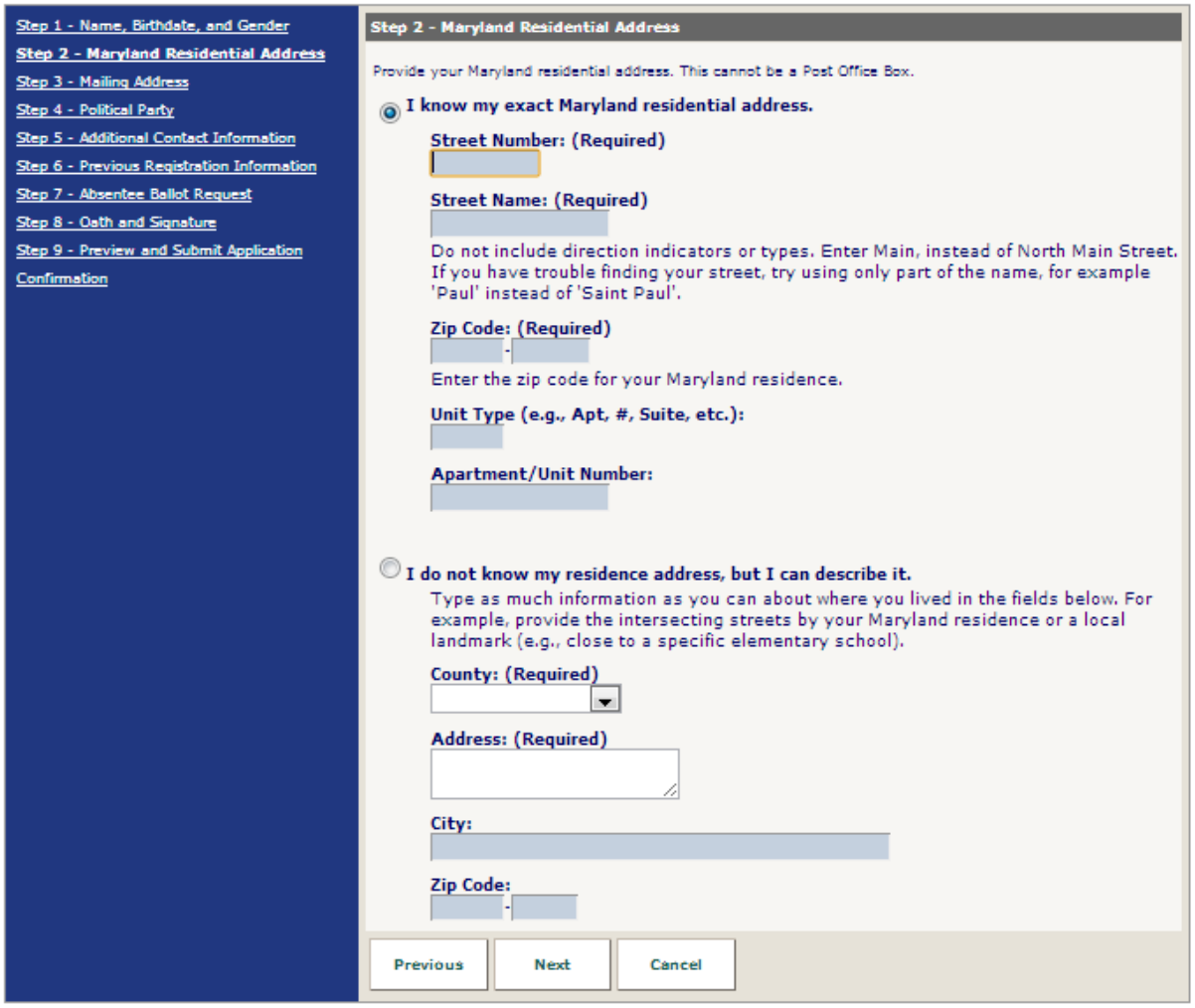
I do not have a Maryland driver's license or MVA ID card number. I will provide the last four digits of my Social Security number and agree to use it as my signature.

Last four digits of Social Security Number: (Required)

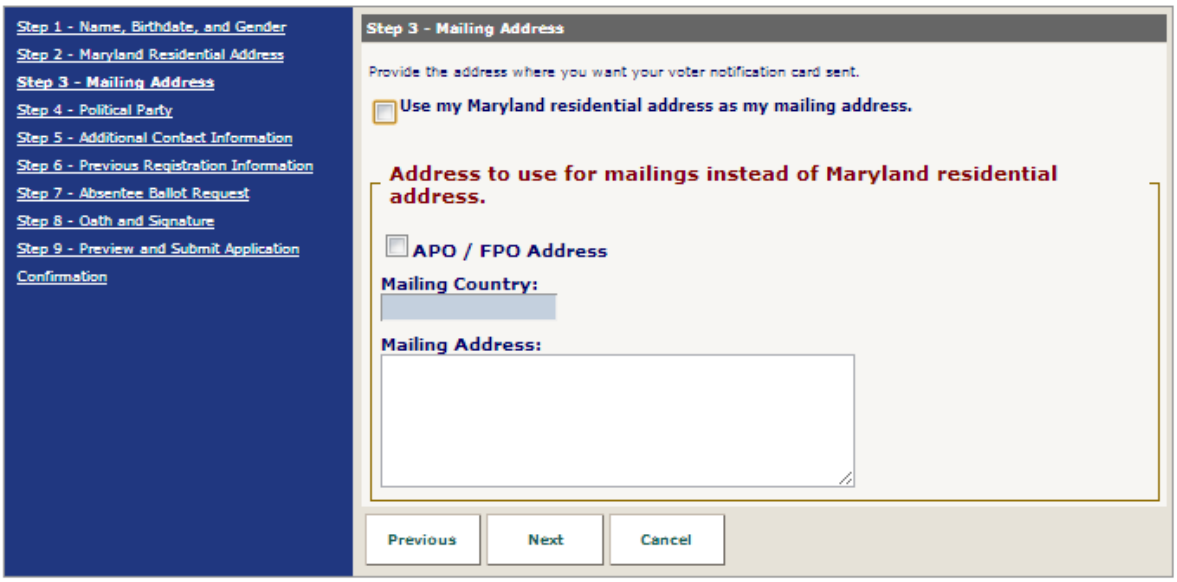
Please only click "next" one time. Verification may take a few moments.

Next Cancel

Step 2 – Residential Address



Step 3 – Mailing Address



For political party, contact information, and previous registration information, see domestic path screens.

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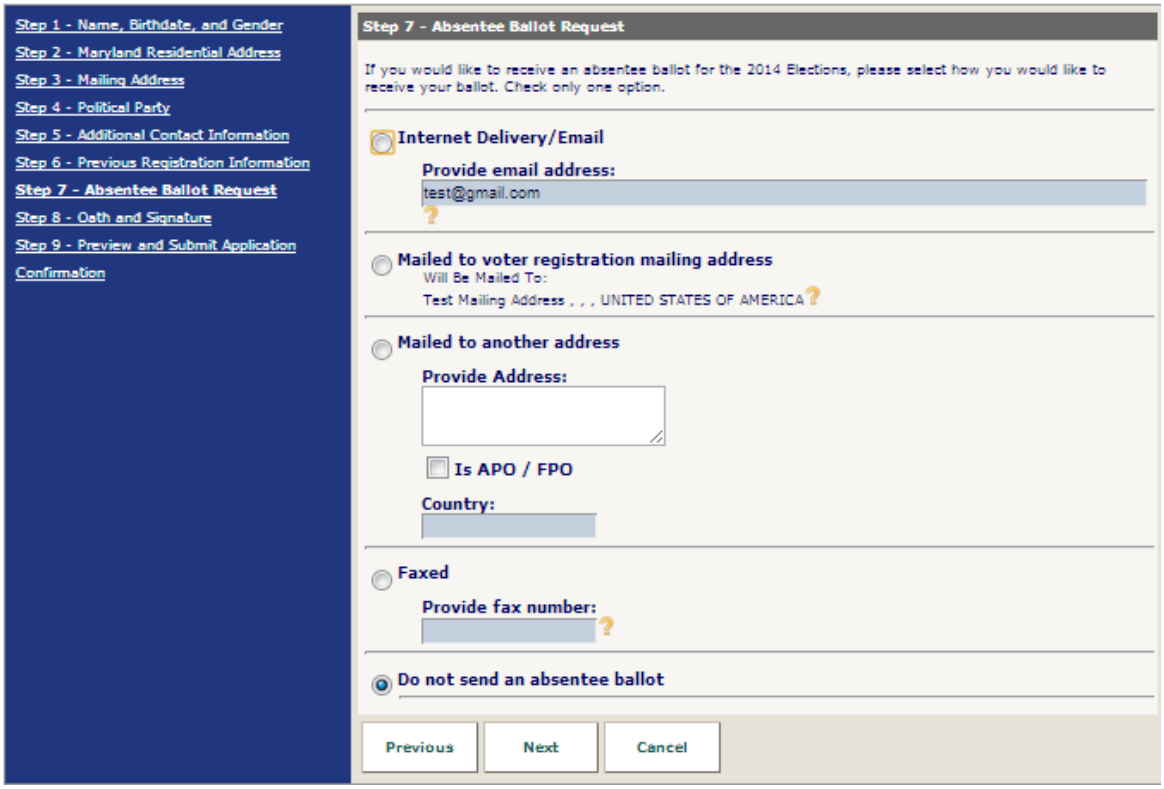
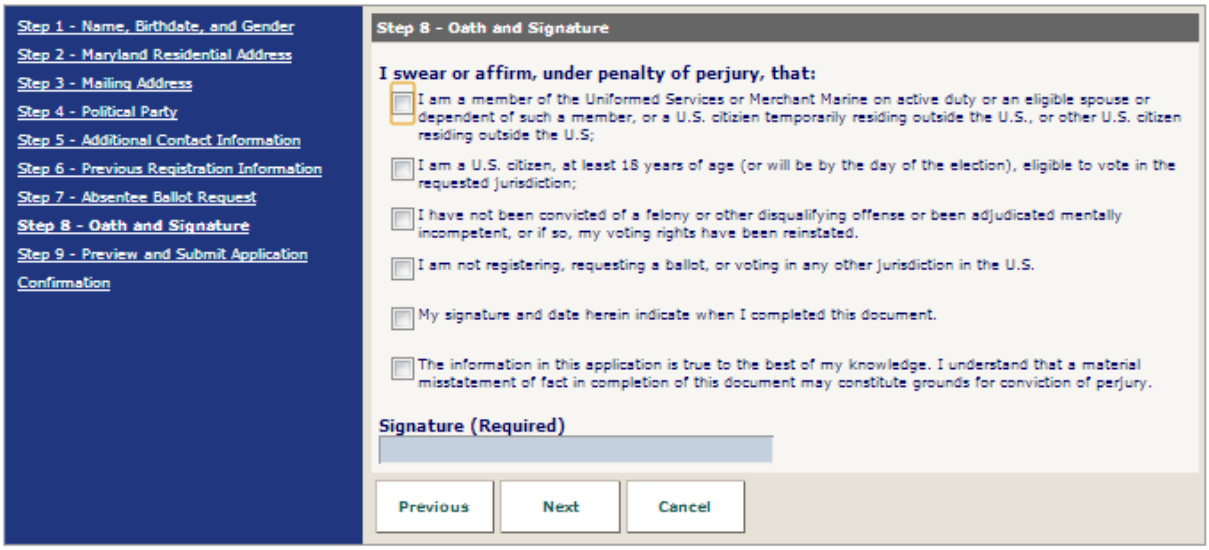
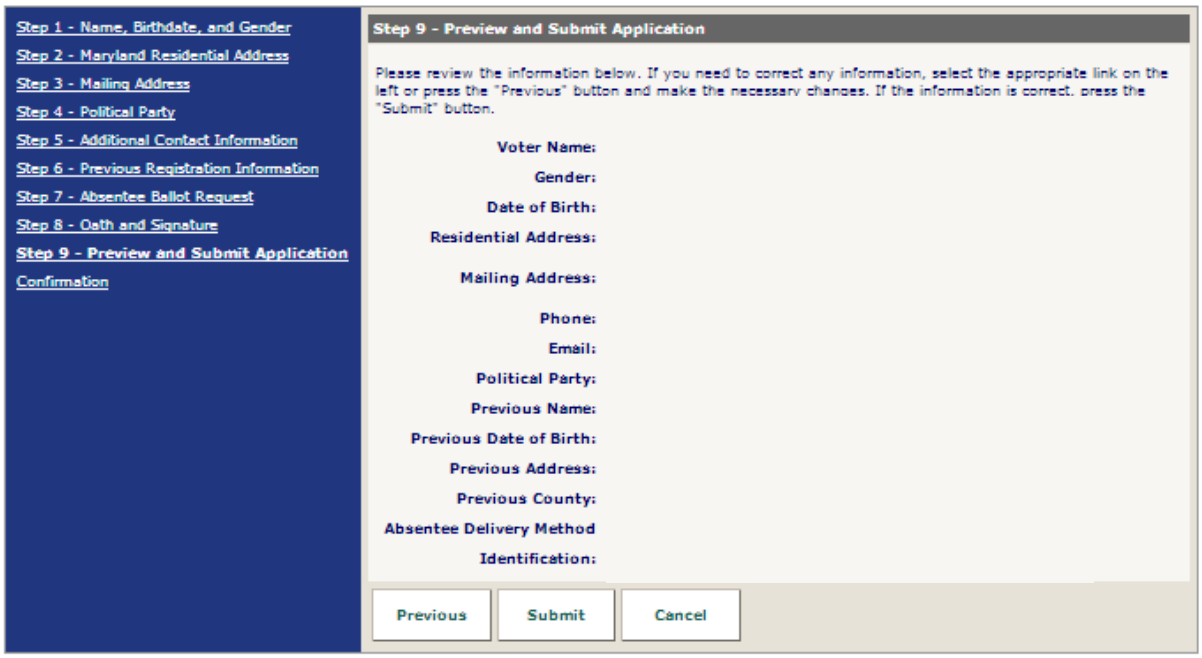
Step 7 – Absentee Ballot Request



Step 8 – Oath and Signature



Step 9 – Preview and Submit



For confirmation page, see domestic path screen.

APPENDIX G -OLVR FUNCTIONALITY

Not all specifications are included here, but the primary functionality is described.

- The Online Voter Registration (OLVR) was authorized by the Maryland Legislature in 2011 and was implemented on July 9, 2012. OLVR shares a middleware layer with the Motor Voter project and implementation required changes to MDVOTERS in order to batch records received from the middleware process.

- The Maryland OLVR system is a web application that allows voters to register to vote or edit existing voter registration information from any computer with internet access. Receipt of the data is managed through OLVR, but duplicate checks and checks for deceased or felon matches are performed in MDVOTERS by the local election boards.

- OLVR uses a live interface with the MVA for voter identification verification.

- OLVR does not directly access MDVOTERS. Instead it reads from data loaded from MDVOTERS into a separate database the previous night.

- OLVR allows a voter to submit electronic VRAs to either modify their existing voter registration record or register for the first time. However, OLVR is unaware of whether the voter is a new or is submitting an update.

- All VRAs submitted by Domestic Voters require an MVA issued ID number that can validate at the time of online submission of their VRA. Validation also requires the voter's name, last four digits of SSN, and driver's license issue date. The official signature on the MVA record becomes the signature on record OLVR. By law MVA has 5 days to provide a signature but in practice

MVA provides the signature at the time of validation during the registration process.

- All VRAs submitted by Domestic Voters will require a standard Maryland residential street address that verifies against the OLVR copy of the MDVOTERS street files.

- UOCAVA voters may provide either their MVA issued ID number or the last four digits of their United States Social Security Number. If they use their MVA issued ID number, they will be required to also provide the last four digits of their SSN and the date their ID was issued, and the official signature on the record will be the signature on record with the MVA. If they use only the last four digits of their SSN, the official signature on the record will be an image of their name with the statement "authorized by last four digits of SSN." If the voter is new, they will be saved as a pending voter until MDVOTERS is able to authenticate their SSN by following the same procedure as all other SSN verification.

- VRAs submitted by UOCAVA voters can include a nonstandard, unverified street address that the LBE will manually verify upon receipt of the record.

- If a voter is unable to provide all the required data they will be required to use the standard paper VRA which they will need to complete manually, sign, and mail in to their local board for processing.

- All voters will be required to agree to each point found on the standard VRA oath for their voter type. Domestic Voters will be presented the Oath from the Maryland VRA and UOCAVA Voters will be presented with the Oath from the FPCA.

- UOCAVA voters will be able to request an absentee ballot using OLVR. OLVR must provide MDVOTERS with all the information necessary to save a data range absentee ballot request.

- As of 2013 the Legislature approved allowing domestic voters to request an absentee ballot using OLVR. This will be implemented by August of 2013 and will provide MDVOTERS all the information necessary to save an election-specific absentee ballot request.

- Domestic voters must be able to specify if they require polling place assistance.

- Domestic voters must be able to specify if they are interested in become an Election judge.

- All voters must be able to provide information on both current name, address, and date of birth as well as previous name, address, and date of birth.

- The data will be processed nightly using the same middleware as the Motor Voter VRA process. That process creates VRA images which will display for the local board of elections to use as a reference during record verification. The PDF generated for the Domestic Voters will be a Maryland Style VRA. The PDF generated for UOCAVA voters will be a Maryland Style FPCA. The images must be stamped with the signature provided from the MVA, if applicable.

- All successful applications must provide the voter with a unique confirmation number that will stay associated with that VRA permanently.

- If ID verification with the MVA fails, the user will be notified of the failure, but not of the reasons for the failure.

- The user must indicate if he or she is a UOCAVA or a Domestic Voter and be provided with appropriate ID requirements.

- The user must sign the appropriate oath verifying eligibility.

- Security is of the utmost concern for this type of application, so stored procedures with no dynamic SQL will be the only way the Web application will access the database.

- The managers would like to make this application available to other states upon request, so the data access layer should be easily adaptable to SQL Server. Future plans for enhancement should include making the UI configurable in the Web Config file.

- Maximum uptime is required, so the data update process should be managed in a way that minimizes downtime to 15 minutes or less every night. Current processes keep downtime to about 10 seconds.

- The system must be fully accessible to the disabled users.

- Every attempt to use OLVR must be logged.

- Every attempt to save a VRA using OLVR must be logged, whether it succeeds or fails.

- Every attempt to verify against the MVA database must be logged, along with a success or failure indication and the reason for failure if applicable.

- Every application attempt must reviewed for security violations and rejected if there is reasonable belief that the user is not human.

- The system must be available in both English and Spanish.

- OLVR will include tooltips and appropriate help notices on the website itself. No additional user documentation will be provided.

- Validation will occur whenever the user attempts to move forward or backward in the wizard, using either the menu on the left or the next button.

- Validation errors will prevent the user from moving from the current step in the wizard. The errors will be displayed in red immediately below the field with an error. The error must also be provided in the tooltip for the control that needs correction.
- Required fields will be denoted with the word “Required”.
- The user must have the opportunity to preview the data before submitting it.
- The user must be able to leave the preview to edit the data.
- The user must be able to preview again after editing the data.
- Validation must occur on all screens and must pass in order to save the application. If the attempt to save finds a screen with invalidate or incomplete data, the error message must be appear above the preview data.
- The preview must show both the VRA data and the absentee application data.
- If the user is UOCAVA, the record is a new VRA, and they provide an SSN, the record will be submitted and stored in the voter registration as Pending-ID Not Verified.
- A unique confirmation number, consisting of part of the voter name, the date, and a random number, will be generated for every OLVR VRA.
- All users will see a confirmation page with their confirmation number.
- The confirmation number must be part of the application that gets saved in MDVOTERS.
- Signature images can be no more than 3kb, compressed.
- VRA images can be no more than 60kb, compressed.
- OLVR must be used over https.

- Each page refresh should take no more than 2 seconds.
- Saving the application should take no more than 10 seconds.